

# South Dakota Department of Transportation

## LOCAL ROADS PLAN



2011



## **INTRODUCTION**

The Local Roads Plan is a document prepared by the South Dakota Department of Transportation, through its office of Local Transportation Programs, for use by the counties and cities throughout South Dakota. The Local Roads Plan is a guideline for use in planning, designing, and constructing roads and bridges on local government highway systems. This document is not a standalone document and should be used along with the AASHTO publication, "A Policy on Geometric Design of Highways and Streets," the SDDOT Road Design Manual, and other applicable policies and publications. The guidelines have a great deal of flexibility with modifications or design exceptions based on local need, traffic, and accident history. The ultimate goal is to provide a product that will fit local needs and safety considerations at the most reasonable cost possible. The Office of Local Transportation Programs is ready and willing to assist in any transportation endeavor at the local level. If there are any questions concerning current or future project needs, please call (605) 773-3574 to speak with any of its Local Government section staff members.

Reference to the SDDOT internet site should be the primary location for the most current version of information. The following links are provided for this reason.

DOT Home –

<http://www.sddot.com>

Local Government Assistance Home (Location of Local Roads Plan) –

<http://www.sddot.com/fpa/lga>

Road Design Home (Location of Road Design Manual, Bid Items, Standard Plates, Standard Plan Notes) –

<http://www.sddot.com/pe/roaddesign>

Bridge Design Home (Location of Standard Bridge Plan Notes) -

<http://www.sddot.com/pe/bridge>

# **TABLE OF CONTENTS**

## **SECTION I – COUNTY SPONSORED PROJECTS**

### **GENERAL INFORMATION**

1.	<b><u>AUTHORITY AND APPLICABILITY</u></b>	1
2.	<b><u>DEPARTMENT OF TRANSPORTATION, LOCAL TRANSPORTATION PROGRAMS, LOCAL GOVERNMENT SECTION</u></b>	2
3.	<b><u>ALLOTMENT OF FUNDS</u></b>	2
4.	<b><u>PROJECT SELECTION AND PUBLIC INVOLVEMENT</u></b>	3
5.	<b><u>PROGRAMMING, AUTHORIZATION AND SYSTEM REVISION</u></b>	4
6.	<b><u>PRELIMINARY ENGINEERING</u></b>	4
7.	<b><u>CONSTRUCTION – CONTRACT</u></b>	5
8.	<b><u>RIGHT-OF-WAY</u></b>	6
9.	<b><u>UTILITY ADJUSTMENTS</u></b>	7
10.	<b><u>SAFETY PROGRAM</u></b>	7
11.	<b><u>ACCOUNTING PROCEDURES AND GUIDE COMPLIANCE</u></b>	7
12.	<b><u>USE OF STANDARD FORMS, AGREEMENTS AND CERTIFICATES</u></b>	8
13.	<b><u>FINAL INSPECTION AND ACCEPTANCE</u></b>	8
14.	<b><u>EVALUATION AND REVISION</u></b>	9
15.	<b><u>ADMINISTRATION OF HIGHWAY BRIDGE REPLACEMENT AND REHABILITATION PROGRAM</u></b>	9
16.	<b><u>DESIGN CRITERIA</u></b>	10

### **DESIGN CRITERIA FOR RURAL ROADS**

LOCAL RURAL ROADS	11
Design Traffic Volume	11
Design Speed	11

Sight Distance	12
Grades	13
Alignment	13
Cross Slope	13
Superelevation	13
Number of Lanes	14
Width of Traveled Way, Shoulder, and Roadway	14
Typical Cross Section	15
Surfacing	16
Resurfacing	16
Structures	17
National Bridge Inventory System and SD Codified	
Law Definitions	18
Hydraulic Design Criteria	20
Bridge Rail	20
Bridges to Remain in Place	21
Vertical Clearance	21
Right-of-Way Width	22
Foreslopes	22
Horizontal Clearance to Obstructions	22
Transverse Pipe End Treatments	23
Mailbox and Newspaper Container Guidance	23
Curbs	23
Intersection Design	23
Railroad-Highway Grade Crossings	24
Traffic Control Devices	25
Bicycle Facilities	25
Erosion Control	25
ADA Guidelines	25
REFERENCES	25
<b>RURAL COLLECTORS</b>	<b>27</b>
Design Traffic Volumes	27
Design Speed	27
Sight Distance	27
Grades	28
Alignment	29
Cross Slope	29
Superelevation	29
Number of Lanes	30
Width of Roadway	30
Foreslopes	31
Typical Cross Section	32
Surfacing	33
Resurfacing	33

Structures	34
National Bridge Inventory System and SD Codified Law Definitions	34
Hydraulic Design Criteria	36
Bridge Rail	36
Bridges to Remain in Place	37
Vertical Clearance	37
Horizontal Clearance to Obstructions	37
Transverse Pipe End Treatments	38
Mailbox and Newspaper Container Guidance	38
Right-of-Way Width	38
Intersection Design	39
Railroad-Highway Grade Crossings	39
Traffic Control Devices	40
Erosion Control	40
ADA Guidelines	40
REFERENCES	41

## **SECTION II – CITY SPONSORED PROJECTS**

### **GENERAL INFORMATION**

1.	<b><u>AUTHORITY AND APPLICABILITY</u></b>	42
2.	<b><u>DEPARTMENT OF TRANSPORTATION, LOCAL TRANSPORTATION PROGRAMS, LOCAL GOVERNMENT SECTION</u></b>	43
3.	<b><u>ALLOTMENT OF FUNDS</u></b>	43
4.	<b><u>PROJECT SELECTION AND PUBLIC INVOLVEMENT</u></b>	44
5.	<b><u>PROGRAMMING, AUTHORIZATION AND SYSTEM REVISION</u></b>	44
6.	<b><u>PRELIMINARY ENGINEERING</u></b>	45
7.	<b><u>CONSTRUCTION – CONTRACT</u></b>	46
8.	<b><u>RIGHT-OF-WAY</u></b>	47
9.	<b><u>UTILITY ADJUSTMENTS</u></b>	47
10.	<b><u>SAFETY PROGRAM</u></b>	48
11.	<b><u>ACCOUNTING PROCEDURES AND GUIDE COMPLIANCE</u></b>	48
12.	<b><u>USE OF STANDARD FORMS, AGREEMENTS AND CERTIFICATES</u></b>	49
13.	<b><u>FINAL INSPECTION AND ACCEPTANCE</u></b>	49

14.	<b><u>EVALUATION AND REVISION</u></b>	49
15.	<b><u>ADMINISTRATION OF HIGHWAY BRIDGE REPLACEMENT AND REHABILITATION PROGRAM</u></b>	50
16.	<b><u>DESIGN CRITERIA</u></b>	50

## **DESIGN CRITERIA FOR URBAN ROADS**

<b>URBAN COLLECTORS</b>	<b>51</b>
Design Traffic Volume	51
Design Speed	52
Sight Distance	52
Grades	53
Alignment	54
Cross Slope	54
Superelevation	54
Number of Lanes	55
Width of Roadway	55
Parking Lanes	56
Medians	57
Curbs	58
Drainage	58
Sidewalks	59
Driveways	59
Roadway Widths for Bridges	60
Vertical Clearance	61
Horizontal Clearance to Obstructions	61
Right-of-Way Width	62
Provision for Utilities	62
Border Area	62
Intersection Design	63
Railroad-Highway Grade Crossings	63
Street and Roadway Lighting	64
Traffic Control Devices	65
Erosion Control	65
Landscaping	65
ADA Guidelines	66
REFERENCES	66
<b>URBAN ARTERIALS</b>	<b>67</b>
General Characteristics	67
General Design Considerations	67
Design Speed	68

Design Traffic Volume	68
Levels of Service	68
Sight Distance	69
Alignment	69
Grades	69
Superelevation	70
Cross Slope	70
Vertical Clearances	71
Lane Widths	71
Curbs and Shoulders	71
Number of Lanes	72
Width of Roadway	72
Drainage	73
Parking Lanes	73
Borders and Sidewalks	74
Railroad-Highway Crossings	75
Roadway Width for Bridges	75
Bridges to Remain in Place	76
Horizontal Clearance to Obstructions	76
Right-of-Way Width	76
Traffic Barriers	77
References for Additional Items	77
ADA Guidelines	77
REFERENCES	77

**APPENDIX 1 - VERY LOW-VOLUME LOCAL ROADS (ADT  $\leq$  400) –  
Information from Chapter 4, Design Guidelines, of the 2001  
edition of the AASHTO publication, “Guidelines for  
Geometric Design of Very Low-Volume Local Roads (ADT  $\leq$   
400)”**

**APPENDIX 2 - FORMS AND PROCEDURES FOR ACQUISITION OF RIGHT-  
OF-WAY FOR FEDERALLY ASSISTED PROJECTS**



**LOCAL ROADS PLAN**  
**SECTION I – COUNTY SPONSORED PROJECTS**

**GENERAL INFORMATION**

**1. AUTHORITY AND APPLICABILITY**

Section I of the "Local Roads Plan" (hereinafter referred to as the "Plan") is a written statement setting forth the standards and procedures to be followed in location, design, construction, and administration of work on the Federal-aid System, under the jurisdiction of the counties, and on applicable roads not on the Federal-aid System. The goal of the South Dakota Department of Transportation (SDDOT) is to permit maximum flexibility and encourage local initiative and cooperation in selecting, developing and constructing projects under the Plan.

The SDDOT will administer projects financed with Surface Transportation Program (STP) funds on roads functionally classified, as per 23 U.S.C. section 133 (Federal-aid System), under the provisions of this Plan. Where Federal-aid is made available for projects not on the Federal-aid System, the SDDOT will administer those projects under this Plan when Federal regulation permits. All phases of project activity will be accomplished in accordance with this Plan and applicable Federal requirements.

The SDDOT will administer projects financed with the Highway Bridge Replacement and Rehabilitation Program (HBRRP) funds on bridges both on and off of the Federal-aid highways, as per 23 U.S.C. section 144 and 23 CFR Part 650 subpart D. Where Federal-aid is made available for projects not on the Federal-aid System, the SDDOT will administer those projects under this Plan when Federal regulation permits. All phases of the project activity will be accomplished in accordance with this Plan and applicable Federal requirements.

Authority under the Plan extended from FHWA to the SDDOT does not include FHWA responsibilities under the National Environmental Policy Act of 1969, Section 138 of Title 23, Title VI of the Civil Rights Act of 1964, Title VIII of the Civil Rights Act of 1968 as amended in 1974, and the Uniform Relocation

Assistance and Land Acquisition Policies Act of 1970 (as amended) and 49 CFR Part 24.

Provisions of Section I of the Plan are applicable only to projects sponsored by the counties or other local political subdivisions in cooperation with the applicable county. Projects not included under this Plan are:

- Railroad crossing projects not on the Federal-aid System
- Projects in cities of populations greater than 5000, not on the Federal-aid System.

Legal authority creating the SDDOT, permitting compliance with Title 23 USC, establishing the Federal-aid System and providing standards, specifications and assistance to the counties is contained in SDCL, Chapter 31-1, 31-2, 31-5 and 31-6.

## **2. DEPARTMENT OF TRANSPORTATION, LOCAL TRANSPORTATION PROGRAMS, LOCAL GOVERNMENT SECTION**

The Local Government Section staff within the Office of Local Transportation Programs (LTP), SDDOT, and under the direction of the LTP Program Manager, will be responsible for administration of projects under Section I of the Plan. Advice, consultation and recommendations are available from all sections within the SDDOT and will be requested and coordinated by the LTP Program Manager.

The primary function of the LTP Local Government Section is to provide the counties with information and guidance on all phases of the Plan on a continuous basis and assure compliance with all Federal and State requirements. Cooperation with local government officials will be continuous during project selection, development and construction.

The Region Engineer will be responsible for the construction administration of the projects.

## **3. ALLOTMENT OF FUNDS**

STP funds are allocated to the 66 counties based on the following formula: \$1 per person in a Class I city (population over 5,000) within a county will be distributed to that county with that amount deducted from the total of the STP

funds allocated to the 66 counties, of the remaining funds one-third is distributed based on a county's highway system miles compared to the total county system miles statewide, one-third is distributed based on a county's rural population (including cities under 5,000) compared to the total state rural population, and one-third is distributed based on a county's land area compared to the total state land area. Authority for apportionment of funds is by action of the SDDOT Transportation Commission. County officials will be advised of their STP Fund balance annually.

#### **4. PROJECT SELECTION AND PUBLIC INVOLVEMENT**

Projects will be selected by the Board of County Commissioners (or Board of City Commissioners for city owned structures) in cooperation with the SDDOT and other appropriate local officials. The county (or city for city owned structure projects) is the political entity that will be held responsible by SDDOT for all required documents, actions and functions during project development, construction and for required future project maintenance.

Public and interagency involvement and consideration of social, economic and environmental effects will be processed in accordance with SDDOT Public Involvement/Public Hearing Process, Paragraph E Section I and applicable portions of Section II, III and IV and with 23 CFR 771. SDDOT will provide assistance to the counties in assuring compliance with Public Involvement Procedures. The environmental classification will be submitted at an appropriate time after program submission for concurrence by the FHWA except for projects that require significant right-of-way, 404 permits, wetland findings, 4(f) statements, Environmental Assessments or Environmental Impact Statements. These projects will require an individual environmental classification approved by FHWA prior to advertising for bids.

All projects requiring acquisition of significant amounts of right-of-way, temporary easements or that substantially change the layout or function of connecting roads or have a significant adverse impact on abutting property or have significant environmental impact will require a public hearing, or public

meeting providing a Notice of Opportunity for Public Hearing in accordance with the SDDOT Public Involvement/Public Hearing Process.

## **5. PROGRAMMING, AUTHORIZATION AND SYSTEM REVISION**

The annual statewide program of county sponsored projects will be submitted as part of the Statewide Transportation Improvement Program (STIP) to the FHWA for approval before the first of October. Project requests in resolution form should be submitted by the Board of County Commissioners prior to the first of April each year for consideration and approval by the SDDOT and inclusion in the annual program. A supplemental program or programs may be submitted if required, depending on need.

Selection of the Federal-aid System shall be accomplished cooperatively by the SDDOT and appropriate local officials. Revision of the county portion of the Federal-aid System shall be by request of the Board of County Commissioners in resolution form subject to approval of the SDDOT and the FHWA. System revision will be accomplished in accordance with 23 CFR.

## **6. PRELIMINARY ENGINEERING**

Survey, design and plan preparation will be accomplished by the county, consulting engineering firms, or the SDDOT. Agreements for engineering services by consultants with Federal participation will be in accordance with 23 CFR 172 and the SDDOT Policy for Procuring Consultant Engineering Services.

Project plans will be reviewed by the county, LTP Local Government Section, Region Engineer, Area Engineer, applicable central offices within the SDDOT, and FHWA if applicable.

Review of hydraulics, foundations, materials, surfacing, construction and permanent traffic signing, or recommendations as applicable, will be provided by the SDDOT on all projects. Economic studies will be provided by the SDDOT if required, or upon request on all projects.

When required, Section 404 permits will be obtained by the SDDOT and required contract provisions included in the contract proposal.

Where projects include unusual or complex bridges, bridges that are estimated to cost over \$5 million or have other unusual features, preliminary plans will be submitted to FHWA for review and technical guidance.

Project plans will be approved by the LTP Local Government Section prior to scheduling for letting.

The South Dakota Standard Specifications for Roads and Bridges (latest edition), Supplemental Specifications, Special Provisions, and required contract provisions as applicable, will be made a part of the contract documents on all projects. Standard title and typical plan sheets for most all types of work are available and will be used to the maximum extent practicable to provide uniformity and economy.

## **7. CONSTRUCTION - CONTRACT**

Projects will be let to contract by the SDDOT in accordance with 23 CFR 635 and South Dakota State Law. Contract award will be made by the State Transportation Commission subject to concurrence by the Board of County Commissioners.

Adequate justification will be formally documented and retained in the project file when bids are substantially higher than the engineers estimate, are unusual or have substantial variations. The guidelines included in the FHWA 'Guidelines on Preparing Engineer's Estimate, Bid Reviews and Evaluation' (which replaces FHWA Technical Advisories TA T 5080.4 and 5080.6) will be used to evaluate bids received. Where the low bid does not meet the guidelines and the county desires to award the contract as bid, justification will be submitted to SDDOT. Where the low bid does meet the guidelines and the county desires to reject all bids, justification will be submitted to SDDOT.

Construction engineering will be provided on all projects in accordance with current operating policy as defined by policy letters and procedures issued by the SDDOT Operations Division. Project supervision will be at the direction of the SDDOT Area Engineer. All projects will be constructed in accordance with current South Dakota Standard Specifications for Roads and Bridges. Quality

control, sampling, testing and material certification will be performed in accordance with the SDDOT Materials Manual.

Approval authority for routine construction change orders rests with the Region Engineer and the County Highway Superintendent. Construction change orders shall be prepared and processed in accordance with the Division of Operation's current policies concerning construction change orders.

Construction change orders that involve a change in the scope of the work or substantial cost increase (greater than 20% over the total project cost), as determined by the Region Engineer and the County Highway Superintendent, will be reviewed with the LTP Local Government Section prior to approval. Approval of the construction change orders will be in accordance with the Division of Operation's current policies concerning construction change orders. In the event that the change in scope is significant or involves work beyond the project termini, a re-evaluation of the environmental document shall be coordinated with the SDDOT Environmental Office.

## **8. RIGHT-OF-WAY**

Appraisals will be the responsibility of the county and may be accomplished by the Director of Equalization, staff appraisers or fee appraisers. The LTP Local Government Section, as assisted by Right-of-Way Program personnel, will review the appraisals and supervise right-of-way acquisition procedures. The negotiation process will be the responsibility of a qualified individual within the county. Relocation Assistance, if required, will be accomplished by Right-of-Way Program personnel within the SDDOT upon request by the LTP Local Government Section. Prior to advertising of contracts the FHWA Division Administrator will be furnished a Right-of-Way Certification on all projects to assure compliance with applicable provisions of Right-of-Way Directives and approved procedures.

Appendix 2 contains a detailed description of the right-of-way acquisition procedure. The required, pre-approved, right-of-way forms can be requested from the LTP Local Government Section at any time.

The county may request the SDDOT Right-of-Way Office to perform appraisals, review appraisals, negotiations, and acquisitions on behalf of the county on a case-by-case basis. Condemnation proceedings are handled by the county.

#### **9. UTILITY ADJUSTMENTS**

Adjustment of Utilities and Railroads will be in accordance with South Dakota State Law and 23 CFR 645. The county is responsible for utility notification and coordinating any utility relocation work. Assistance can be requested of the Utility Coordinator of the SDDOT Project Development Office.

Utility facilities will be adjusted or removed from the right-of-way in cases where they constitute a safety hazard. Minimum lateral clearances as shown in the 'Design Criteria for Rural Roads' section of this document, as applicable, may be allowed on a project by project basis considering traffic volume, right-of-way width, removal cost and location. Exceptions to these criteria shall be approved by the LTP Program Manager.

#### **10. SAFETY PROGRAM**

A continuing safety improvement effort will be provided to local officials by all elements of the SDDOT using Safety Funds and normal Federal-aid Funds. Areas receiving priority and emphasis are design standards, individual project design, permanent traffic signing, construction signing, pavement marking, removal of roadside obstacles, elimination of deficient bridges, stand alone rumble strips, and rumble stripes.

The SDDOT Traffic Safety Engineer is available to provide safety related services to local agencies upon request. Typical services available include traffic control signing recommendations, intersection geometrics recommendations, crash data, cost-benefit studies for proposed safety projects, and Road Safety Audit Reviews.

#### **11. ACCOUNTING PROCEDURES AND GUIDE COMPLIANCE**

Accounting control and current billing will be in accordance with procedures established through the FHWA Stewardship agreements and through the SDDOT Finance Office.

Audits and Internal Review will evaluate selected projects and activities for Plan compliance. Reports of review, deficiencies and corrective actions will be furnished to Office Supervisors, Division Directors, Region Engineers, applicable Program Managers, Area Engineers, FHWA and local officials.

Assurance of compliance by local officials with existing and subsequent Federal or State Laws and requirements will be provided by the LTP Local Government Section by continuous review of all phases of each project. Changes in the current Plan or policy will be provided by the LTP Local Government Section by direct mailing and will be discussed at various State, Area, and local government meetings.

## **12. USE OF STANDARD FORMS, AGREEMENTS AND CERTIFICATES**

The following standard forms will be used on all projects as applicable. Forms will be revised as necessary to comply with future changes in Federal or State Laws and regulations.

- Program Resolution (includes Maintenance Agreement acknowledgment)

- Funding Agreement (if needed)

- Design Sheets

- Public Hearing Standard Forms

- Utilities Certificate

- Right-of-Way Certificate

- All Right-of-Way Acquisition Forms

- Letting Authorization

- Encroachment Survey

All forms are available from the LTP Local Government Section.

## **13. FINAL INSPECTION AND ACCEPTANCE**

A final inspection will be made of each completed project by a representative of the applicable local authority and the Region Engineer. The Region Engineer will furnish notification of final inspection and acceptance to the Division of Operations.

The Division of Operations will furnish the notification of project completion to the FHWA. All project records and documents will be available for review and



inspection by FHWA officials at all times during project development and construction, and will be retained and available as per 23 CFR 17 for review and inspection for a three year period after payment of the final voucher to FHWA for the project.

#### **14. EVALUATION AND REVISION**

The Plan will be revised as required by changes in SDDOT operation, significant changes in the 2004 edition of the AASHTO publication, "A Policy on Geometric Design of Highways and Streets and the 2001 edition of the AASHTO publication, "Guidelines for Geometric Design of Very Low-Volume Local Roads (ADT  $\leq$  400)", where review has shown change to be desirable, or due to changes in applicable Federal and State Laws, orders and directives. Revisions of the Plan documented, dated and issued to local officials. Changes of the Plan may be initiated by the counties or the South Dakota Department of Transportation, through the LTP Local Government Section.

#### **15. ADMINISTRATION OF HIGHWAY BRIDGE REPLACEMENT AND REHABILITATION PROGRAM**

23 CFR 650D (Highway Bridge Replacement and Rehabilitation Program) provides for administration of bridge replacement and rehabilitation projects under provisions of the approved Plan.

Bridge replacement and rehabilitation projects, both on and off the Federal-aid System, sponsored by a county or other local political subdivision including cities, will be administered in accordance with this Plan. Design standards will be in accordance with the Design Criteria sections of this document.

Special Bridge Replacement and Rehabilitation Funds apportioned to the State of South Dakota are divided as follows: fifty percent (50%) is made available to the cities and counties and fifty percent (50%) is retained by the State. The 50% made available to cities and counties is available for eligible projects on a statewide basis with sufficiency rating of the structure a significant consideration in prioritizing project requests that are submitted. Not less than 30% or more than 70% of the funds made available to the cities and counties

shall be expended for projects located on public roads other than those on the Federal-aid System.

## **16. DESIGN CRITERIA**

Design criteria will be in accordance with the 2004 edition of the AASHTO publication, "A Policy on Geometric Design of Highways and Streets," referred to in this publication as 'AASHTO Green Book.' Projects on the Federal-aid System under the jurisdiction of the counties will be designed to meet the criteria found in Chapter 6, Collector Roads and Streets. Projects not on the Federal-aid System will be designed to meet the criteria found in Chapter 5, Local Roads and Streets. Most of this information is reproduced within the 'Design Criteria for Rural Roads' section of this document within paragraphs of indented and single-spaced format. To maintain uniformity, exhibit and reference numbers have not been changed from those shown in the AASHTO Green Book. All exhibits in the body of the Plan are in English units and any chapters referenced are as found in the AASHTO Green Book.

Design criteria for local roads with ADT of  $\leq 400$  is included in this document and will be in accordance with the 2001 edition of the AASHTO publication, "Guidelines for Geometric Design of Very Low-Volume Local Roads (ADT  $\leq 400$ )", referred to in this document as 'AASHTO Low Volume Guide.' Appendix 1 contains this information reproduced from Chapter 4, Design Guidelines, of the AASHTO Low Volume Guide. To maintain uniformity, exhibit and reference numbers have not been changed from those shown in the AASHTO Low Volume Guide. All exhibits in Appendix 1 are in English units and any chapters referenced are as found in the AASHTO Low Volume Guide.

The best possible design should be selected considering safety, existing and future needs, economy, reasonable maintenance costs and available funding. In restricted areas, or where there are other unusual considerations, it may not be possible to meet all minimum design values. Exceptions to applicable design criteria will be considered upon request by the county on a project by project basis when in the public interest and subject to approval by the SDDOT.

## DESIGN CRITERIA FOR RURAL ROADS

### LOCAL RURAL ROADS

#### Design Traffic Volume

Roads should be designed for a specific traffic volume and a specified acceptable level of service. The average daily traffic (ADT) volume, either current or projected to some future design year, should be the basis for design. Usually, the design year is about 20 years from the date of completion of construction but may range from the current year to 20 years depending on the nature of the improvement.

#### Design Speed

Design speed is a selected speed used to determine the various design features of the roadway. Geometric design features should be consistent with a specific design speed selected as appropriate for environmental and terrain conditions. Designers are encouraged to select design speeds equal to or greater than the minimum values shown in Exhibit 5-1. Low design speeds are generally applicable to roads with winding alignment in rolling or mountainous terrain or where environmental conditions dictate. High design speeds are generally applicable to roads in level terrain or where other environmental conditions are favorable. Intermediate design speeds would be appropriate where terrain and other environmental conditions are a combination of those described for low and high speed. Exhibit 5-1 lists values for minimum design speeds as appropriate for traffic needs and types of terrain; terrain types are discussed further in Chapters 2 and 3 (*of the AASHTO Green Book*).

**Minimum Design Speeds for Local Rural Roads**  
**Exhibit 5-1, page 381, AASHTO 2004.**

Type of terrain	Design speed (mph) for specified design volume (veh/day)					
	under 50	50 to 250	250 to 400	400 to 1500	1500 to 2000	2000 and over
Level	30	30	40	50	50	50
Rolling	20	30	30	40	40	40
Mountainous	20	20	20	30	30	30

It is desired that a design speed of 50 mph be considered first in the design of Local Rural Roads.

## Sight Distance

Minimum stopping sight distance and passing sight distance should be as shown in Exhibits 5-2 and 5-3. Criteria for measuring sight distance, both vertical and horizontal, are as follows: For stopping sight distance, the height of eye is 3.5 ft and the height of object is 2 ft; for passing sight distance, the height of object is 3.5 ft. Chapter 3 (*of the AASHTO Green Book*) provides a general discussion of sight distance.

**Design Controls for Stopping Sight Distance for Crest and Sag Vertical Curves  
Exhibit 5-2, page 381, AASHTO 2004.**

Initial speed (mph)	Design stopping sight distance (ft)	Rate of vertical curvature, $K^a$ (ft/%)	
		Crest	Sag
15	80	3	10
20	115	7	17
25	155	12	26
30	200	19	37
35	250	29	49
40	305	44	64
45	360	61	79
50	425	84	96
55	495	114	115
60	570	151	136

<sup>a</sup> Rate of vertical curvature,  $K$ , is the length of curve per percent algebraic difference in the intersecting grades (i.e.,  $K = L/A$ )

**Design Controls for Crest Vertical Curves Based on Passing Sight Distance  
Exhibit 5-3, page 382, AASHTO 2004.**

Design speed (mph)	Design passing sight distance (ft)	Rate of vertical curvature, $K_a$ (ft/%)
20	710	180
25	900	289
30	1090	424
35	1280	585
40	1470	772
45	1625	943
50	1835	1203
55	1985	1407
60	2135	1628

<sup>a</sup> Rate of vertical curvature,  $K$ , is the length of curve per percent algebraic difference in the intersecting grades (i.e.,  $K = L/A$ )

## Grades

Suggested maximum grades for local rural roads are shown in Exhibit 5-4.

### Maximum Grades for Local Rural Roads

Exhibit 5-4, page 382, AASHTO 2004.

Type of terrain	Maximum grade (%) for specified design speed (mph)								
	15	20	25	30	40	45	50	55	60
Level	9	8	7	7	7	7	6	6	5
Rolling	12	11	11	10	10	9	8	7	6
Mountainous	17	16	15	14	13	12	10	10	—

## Alignment

Alignment between control points should be designed to be as favorable as possible consistent with the environmental impact, topography, terrain, design traffic volume, and the amount of reasonably obtainable right-of-way. Sudden changes between curves of widely different radii or between long tangents and sharp curves should be avoided. Where practical, the design should include passing opportunities. Where crest vertical curves and horizontal curves occur together, there should be greater than minimum sight distance to ensure that the horizontal curves are visible to approaching drivers.

## Cross Slope

Pavement cross slope should be adequate to provide proper drainage. Normally, cross slopes range from 1.5 to 2 percent for high-type pavements and 2 to 6 percent for low-type pavements.

High-type pavements are those that retain smooth riding qualities and good non-skid properties in all weather with little maintenance.

For low-type pavements such as surface treatments, stabilized or loose gravel, or stabilized earth surfaces, a 3 percent cross slope is desirable. For further information on pavement cross slope, see Chapter 4 (*of the AASHTO Green Book*).

## Superelevation

For rural roads with paved surfaces, superelevation should be not more than 12 percent except where snow and ice conditions prevail, in which case the superelevation should be not more than 8 percent. For aggregate roads, superelevation should be not more than 12 percent.

Superelevation runoff is the length of highway needed to accomplish the change in cross slope from a section with the adverse crown removed to a fully superelevated section. Minimum lengths of runoff are given in Chapter 3 (*of the AASHTO Green Book*). Adjustments in design runoff lengths may be desirable for smooth riding, surface drainage, and good appearance. For a general discussion on this topic, see Chapter 3 (*of the AASHTO Green Book*).

Superelevation rates will be according to current SDDOT standards. As stated in the SDDOT Road Design Guide, because of South Dakota's weather conditions, the maximum permissible rate of superelevation is 6%. This will apply to all paved surface roads. The maximum permissible rate of superelevation on gravel surface roads will be 8%. If other conditions arise that warrant consideration of greater rates, these will be discussed on an individual basis.

### **Number of Lanes**

Two travel lanes usually can accommodate the normal traffic volume on rural local roads. If exceptional traffic volumes occur in specific areas, additional lanes may be provided in accordance with design criteria in Chapter 2 (*of the AASHTO Green Book*). Provisions for climbing and passing lanes are covered in Chapter 3 (*of the AASHTO Green Book*).

### **Width of Traveled Way, Shoulder, and Roadway**

Graded shoulder width is measured from the edge of the traveled way to the point of intersection of shoulder slope and foreslope. The minimum roadway width is the sum of the traveled way and graded shoulder widths give in Exhibit 5-5. Where roadside barriers are proposed, it is desirable to provide a minimum offset of 4 ft from the traveled way to the barrier whenever practical. For further information, see the sections on “Shoulders” and “Longitudinal Barriers” in Chapter 4 (*of the AASHTO Green Book*) and for information on vehicle offtracking, see the section on “Derivation of Design Values for Widening on Horizontal Curves” in Chapter 3 (*of the AASHTO Green Book*).

When bicycle facilities are included as part of the design, refer to *AASHTO’s Guide for the Development of Bicycle Facilities (1)*.

**Minimum Width of Traveled Way and Shoulders**  
**Exhibit 5-5, page 384, AASHTO 2004.**

US Customary				
Minimum width of traveled way (ft) for specified design volume (veh/day)				
Design speed (mph)	under 400	400 to 1500	1500 to 2000	over 2000
15	18	20 <sup>a</sup>	20	22
20	18	20 <sup>a</sup>	22	24 <sup>c</sup>
25	18	20 <sup>a</sup>	22	24 <sup>c</sup>
30	18	20 <sup>a</sup>	22	24 <sup>c</sup>
40	18	20 <sup>a</sup>	22	24 <sup>c</sup>
45	20	22	22	24 <sup>c</sup>
50	20	22	22	24 <sup>c</sup>
55	22	22	24 <sup>c</sup>	24 <sup>c</sup>
60	22	22	24 <sup>c</sup>	24 <sup>c</sup>
Width of graded shoulder on each side of the road (ft)				
All speeds	2	5 <sup>a,b</sup>	6	8

<sup>a</sup> For roads in mountainous terrain with design volume of 400 to 600 veh/day, use 18-ft traveled way width and 2-ft shoulder width.

<sup>b</sup> May be adjusted to achieve a minimum roadway width of 30 ft for design speeds greater than 40 mph.

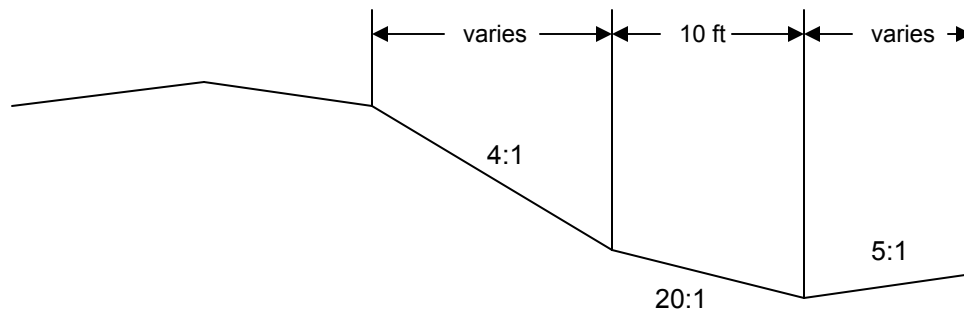
<sup>c</sup> Where the width of the traveled way is shown as 24 ft, the width may remain at 22 ft on reconstructed highways where alignment and safety records are satisfactory.

See text for roadside barrier and offtracking considerations.

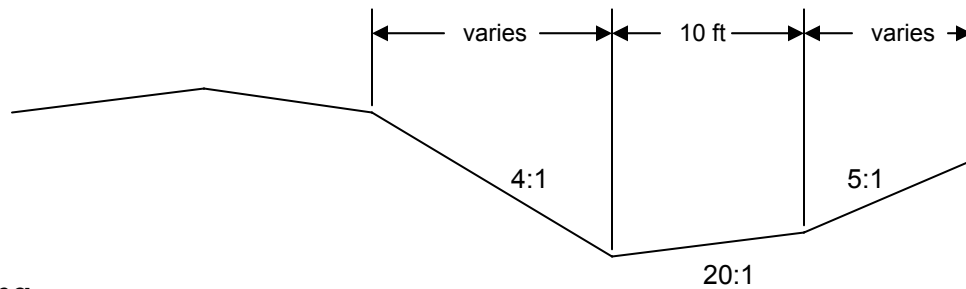
### Typical Cross Section

The typical section will include a crown slope of 0.03 ft/ft for gravel surfaces or 0.02 ft/ft for paved surfaces, 4:1 inslopes, 5:1 backslopes, and a standard 10' ditch at 20:1.

The following typical section keeps the ditch drainage farther from the roadway but requires larger work limits and potentially the need for more right-of-way.



The following typical section works well in areas where the project limits and impact to the right-of-way must be kept to a minimum.



## Surfacing

Surfacing shall be in accordance with current SDDOT standards. The basic minimums are noted in the table below.

**Surfacing Design Minimums for a 20 Year Life Cycle**

ADT	Base	Surface
<400	8" to 10"	Asphalt Surface Treatment *
401 to 750	10"	3" Asphalt Concrete
>750	**	**
*Asphalt surface treatments need to be repeated @ every 4-5 years for optimum performance		
** Base and surface shall be designed according to current SDDOT Standards		

For gravel surfacing, the minimum thickness shall be 4" to 6". Design shall be in accordance with current SDDOT standards and the South Dakota Local Transportation Assistance Program's (SD LTAP) November 2000 *Gravel Roads Maintenance and Design Manual*.

## Resurfacing

Resurfacing projects will be designed according to current SDDOT standards

Signing and marking will be in conformance with the current Manual on Uniform Traffic Control Devices (MUTCD). Particular attention will be given to the use of traffic control devices to assist in mitigating problems associated with substandard geometric features where the deficiency cannot be economically corrected.



At least three years of crash records will be evaluated by the LTP Local Government Section prior to proceeding with a resurfacing project under the resurfacing criteria. Crash history will be used to identify hazardous sites or point out situations where reconstruction to full standards should be considered. Resurfacing projects shall be constructed to preserve and extend the service life of existing highways, enhance highway safety, and provide an appropriate skid resistant surface.

## Structures

The design of bridges, culverts, walls, tunnels, and other structures should be in accordance with the current *Standard of Specifications for Highway Bridges (2)*. Except as otherwise indicated in this chapter and in Chapter 4 (*of the AASHTO Green Book*), the dimensional design of structures should also be in accordance with *Reference (2)*.

The minimum design loading for new bridges on local rural roads should be HS 20.

The minimum clear roadway widths for new and reconstructed bridges should be as given in Exhibit 5-6. For general discussion of structure widths, see Chapter 10 (*of the AASHTO Green Book*).

**Minimum Clear Roadway Widths and Design Loadings  
for New and Reconstructed Bridges**  
Exhibit 5-6, page 386, AASHTO 2004.

US Customary		
Design volume (veh/day)	Minimum clear roadway width for bridges <sup>a</sup>	Design loading structural capacity
400 and under	Traveled way + 2 ft (each side)	HS 20
400 to 2000	Traveled way + 3 ft (each side)	HS 20
over 2000	Approach roadway width <sup>b</sup>	HS 20

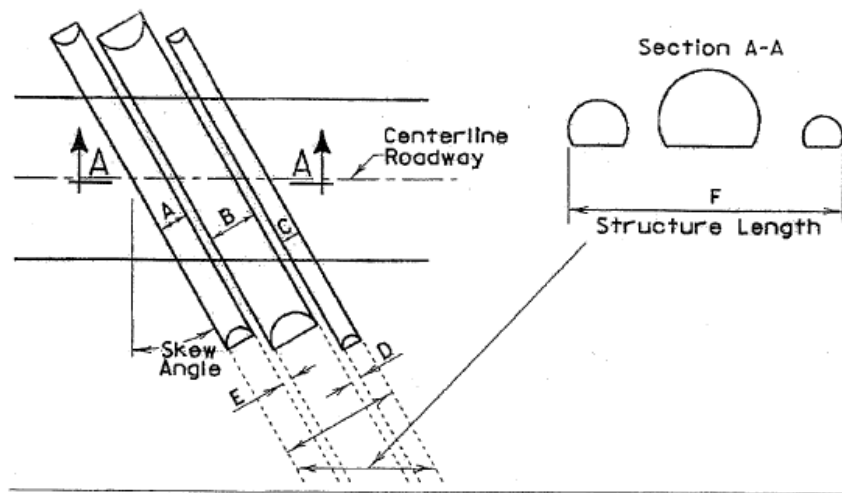
<sup>a</sup> Where the approach roadway width (traveled way plus shoulders) is surfaced, that surface width should be carried across the structures.

<sup>b</sup> For bridges in excess of 100 ft in length, the minimum width of traveled way plus 3 ft on each side is acceptable.

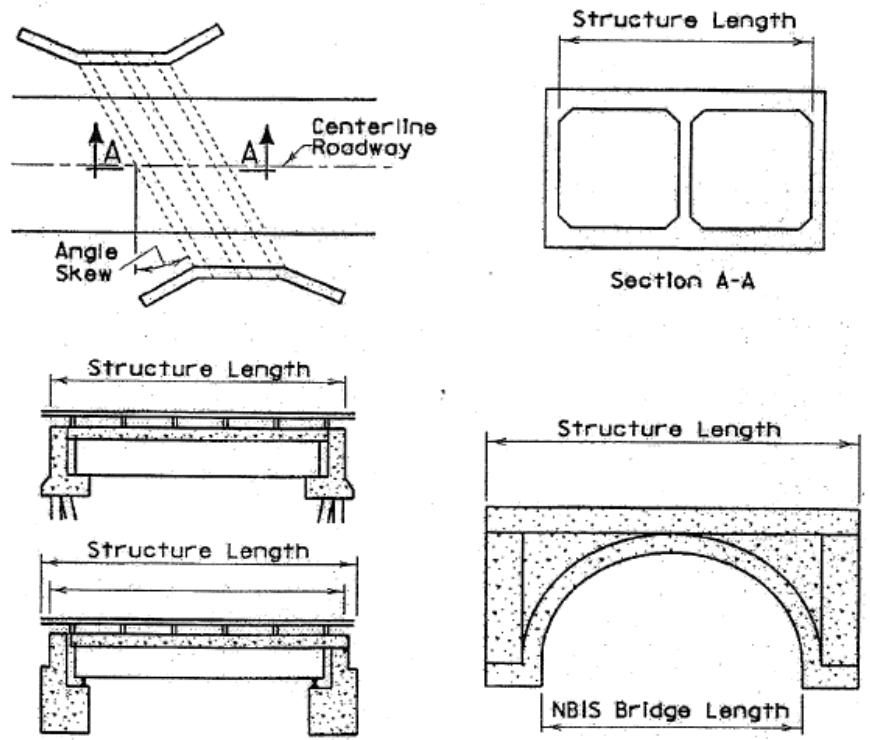
## **National Bridge Inventory System and SD Codified Law Definitions**

A structure is considered a bridge when its length, measured along the center of the roadway, is more than 20 feet from abutment to abutment, or extreme ends of openings for multiple boxes and pipes where the clear distance between the openings is less than half of the smaller opening. In the case of arch pipe, the measurement shall be made at its widest opening. A structure is a culvert when it cannot be classified as a bridge and provides an opening under a roadway. (SDCL 31-14-1) Culverts shall be no less than 24 feet in length. (SDCL 31-12-18)

Diagram from "SD Bridge System Code Manual, 1998 Edition"



Multiple pipes may be considered a bridge if the distance between the pipes is less than half the smallest opening and the structure length is greater than 6.1 meters (20 feet). In the above illustration, distance D and E must be less than half the distance C and distance F must be greater than 6.1 meters (20 feet) for these pipes to be a bridge.



## **Hydraulic Design Criteria**

Flood plain evaluation will be in accordance with 23 CFR 650A. Hydraulic design will normally be for the 10 year storm on Local Rural Road bridge replacement projects with an overflow section in the approach grade. If an overflow section does not exist within the approach grade, a 25 year storm should be used. Bridge replacement projects on Rural Collectors will normally be designed to pass the 25 year storm. If the ADT is less than 100, use the 10 year storm, unless an overflow section does not exist. Low water crossings will be designed using report #FHWA/RD-83/015, Design and Construction of Low Water Stream Crossings, as a guide. Typically the low water crossings are designed using a 2 year design frequency with 1.5 feet of overtopping depth. Scour design will be in accordance with Hydraulic Engineering Circular No. 18 (HEC-18) and riprap design will be in accordance with Hydraulic Engineering Circular No. 11 (HEC-11.)

At locations where the current structure functions hydraulically at a storm event less than those noted above, and extensive grading would be required to make the new structure meet these design storms, the county may request a design exception to maintain the current storm, on a project by project basis.

## **Bridge Rail**

Bridge rail end protection and bridge rail systems that have been crash tested in accordance with NCHRP 350 will be provided on Rural Collectors and Local Rural Roads with ADT's greater than 150. Rural Collectors and Local Rural Roads with ADT's less than 150 may have rail end treatments turned down 15° or flatter and rail systems designed in accordance with NCHRP 350 Test Level 2 or better design criteria. The LTP Local Government Section maintains details for several rail systems that meet the criteria noted. These details also address the type and length of approach rail if applicable.

Rail designs that may be needed for special conditions (i.e. an approach or intersection located within such close proximity to a structure as to interfere with the standard rail placement, rehabilitation of existing rail, etc.) will be in accordance with current SDDOT guidelines.

## Bridges to Remain in Place

Existing substandard structures should be improved, but because of their high replacement cost, reasonably adequate bridges and culverts that meet tolerable criteria may be retained. Some of the non-technical factors that should be considered are the aesthetic value and the historical significance attached to famous structures, covered bridges, and stone arches.

Where an existing road is to be reconstructed, an existing bridge that fits the proposed alignment and profile may remain in place when its structural capacity in terms of design loading and clear roadway width are at least equal to the values given in Exhibit 5-7 for the applicable traffic volume.

The values in Exhibit 5-7 do not apply to structures with total lengths greater than 100 ft. These structures should be analyzed individually, taking into consideration the clear width provided, traffic volume, remaining life of the structure, pedestrian volume, snow storage, design speed, crash history, and other pertinent factors.

**Minimum Structural Capacities and Minimum Roadway Widths for Bridges to Remain in Place**  
**Exhibit 5-7, page 386, AASHTO 2004.**

US Customary		
Design volume (veh/day)	Design loading structural capacity	Minimum clear roadway width (ft) <sup>a,b,c</sup>
0 to 50	H 10	20 <sup>d</sup>
50 to 250	H 15	20
250 to 1500	H 15	22
1500 to 2000	H 15	24
over 2000	H 15	28

<sup>a</sup> Clear width between curbs or rails, whichever is the lesser.

<sup>b</sup> Minimum clear widths that are 2 ft narrower may be used on roads with few trucks. In no case shall the minimum clear width be less than the approach traveled way width.

<sup>c</sup> Does not apply to structures with total length greater than 100 ft.

<sup>d</sup> For single-lane bridges, use 18 ft.

## Vertical Clearance

Vertical clearance at under passes should be at least 14 ft over the entire roadway width, with an allowance for future resurfacing.

## **Right-of-Way Width**

The provision of right-of-way widths that accommodate construction, adequate drainage, and proper maintenance of a highway is a very important part of the overall design. Wide rights-of-way permit the construction of gentle slopes, resulting in greater safety for the motorist and providing for easier and more economical maintenance. The procurement of sufficient right-of-way at the time of the initial improvement permits the widening of the roadway and the widening and strengthening of the pavement at a reasonable cost as traffic volumes increase.

In developed areas, it may be desirable to limit the right-of-way width. However, the right-of-way width should not be less than that required for all the elements of the design cross sections, utility accommodation, and appropriate border areas.

## **Foreslopes**

The maximum rate of foreslope depends on the stability of local soils as determined by soil investigation and local experience. Slopes should be as flat as practical, and other factors should be considered to determine the design slope. Flat foreslopes increase safety by providing a maneuver area in emergencies, are more stable than steep slopes, aid in the establishment of plant growth, and simplify maintenance work. Vehicles that leave the traveled way can often be kept under control if slopes are gentle and drainage ditches are well-rounded. Such recovery areas should be provided where terrain and right-of-way controls permit.

Combinations of rate and height of slope should provide for vehicle recovery. Where controlling conditions (such as high fills, right-of-way restrictions, or the presence of rocks, watercourses, or other roadside features) make this impractical, consideration should be given to the provision of guardrail, in which case the maximum rate of foreslope could be used.

Cut sections should be designed with adequate ditches. Preferably, the foreslope should not be steeper than 1V:2H, and the ditch bottom and slopes should be well-rounded. The backslope should not exceed the maximum required for stability.

## **Horizontal Clearance to Obstructions**

A clear zone of 7 to 10 ft or more from the edge of the traveled way, appropriately graded with relatively flat slopes and rounded cross-sectional design, is desirable. An exception may be made where guardrail protection is provided. The recovery area should be clear of all unyielding

objects such as trees, sign supports, utility poles, light poles, and any other fixed objects that might severely damage an out-of-control vehicle.

To the extent practical, where another highway or railroad passes over, the structure should be designed so that the pier or abutment supports have lateral clearance as great as the clear roadside area on the approach roadway. For further information on providing roadside lateral clearance, see the *AASHTO Roadside Design Guide (3)*.

Where it is not practical to carry the full-width approach roadway across an overpass or other bridge, an appropriately transitioned roadside barrier should be provided. At selected locations, such as the outside of a sharp curve, a broader recovery area with greater horizontal clearances should be provided to any roadside obstruction.

### **Transverse Pipe End Treatments**

End treatments for mainline (transverse) pipe will follow the guidelines in Chapter 10 of the SDDOT Road Design Manual.

### **Mailbox and Newspaper Container Guidance**

Installation of mailboxes and newspaper containers will be in accordance with current SDDOT guidelines. Acceptable support systems shall be used that have been accepted by the Federal Highway Administration (FHWA) based on crash test results.

### **Curbs**

The use of curbs in conjunction with intermediate or high design speeds should be limited, as discussed in Chapter 4 (*of the AASHTO Green Book*). Where curbs are to be used, refer to the discussion on curbs in the section “Local Urban Streets” in this chapter.

### **Intersection Design**

Intersections should be carefully located to avoid steep profile grades and to ensure adequate approach sight distance. An intersection should not be situated just beyond a short-crest vertical curve or on a sharp horizontal curve. When there is no practical alternate to such a location, the approach sight distance on each leg should be carefully checked, and where practical, backslopes should be flattened and horizontal or vertical curves lengthened to provide additional sight distance. The driver of a vehicle approaching an intersection should have an unobstructed view of

the entire intersection and sufficient lengths of the intersecting roadways to permit the driver to anticipate and avoid potential collisions. Sight distances at intersections with six different types of traffic control are presented in Chapter 9 (*of the AASHTO Green Book*).

Intersections should be designed with a corner radius of the pavement or surfacing that is adequate for a selected design vehicle, representing a larger vehicle that is anticipated to use the intersection with some frequency. For minimum edge radius, see Chapter 9 (*of the AASHTO Green Book*). Where turning volumes are significant, consideration should be given to speed change lanes and channelization.

Intersection legs that operate under stop control should intersect at right angles wherever practical, and should not intersect at an angle less than 60 degrees. For further details, see Chapter 9 (*of the AASHTO Green Book*).

### **Railroad-Highway Grade Crossings**

Appropriate grade-crossing warning devices shall be installed at all railroad-highway grade crossings on local roads and streets. Details of the devices to be used are given in the *Manual on Uniform Traffic Control Devices (MUTCD) (4)*. In some States, the final approval of the devices to be used may be vested in the agency having oversight over railroads.

In South Dakota the final approval of these devices is determined as a joint decision between the agency having jurisdiction over the particular road and the applicable railroad.

Sight distance is an important consideration at railroad-highway grade crossings. There should be sufficient sight distance along the road and along the railroad tracks for an approaching driver to recognize the crossing, perceive the warning device, determine whether a train is approaching, and stop if necessary. For further information on railroad-highway grade crossings, see Chapter 9 (*of the AASHTO Green Book*).

The roadway width at all railroad crossings should be the same as the width of the approach roadway. Crossings that are located on bicycle routes that are not perpendicular to the railroad may need additional paved shoulder for bicycles to maneuver over the crossing. For further information, see the *AASHTO Guide for the Development of Bicycle Facilities (1)*.



## **Traffic Control Devices**

Signs, pavement and other markings, and, where appropriate, traffic signal controls are essential elements for all local roads and streets. Refer to the *MUTCD (4)* for details of the devices to be used and, for some conditions, warrants for their use.

Chapter 31-28-11 of the South Dakota Codified Laws states that on any street or road constructed with federal aid, all traffic control devices shall conform to uniform national signing standards. These standards can be found in the MUTCD.

## **Bicycle Facilities**

The local roadway may be sufficient to accommodate bicycle traffic. Where special facilities for bicycles are desired, they should be in accordance with the *AASHTO Guide for the Development of Bicycle Facilities (1)*.

## **Erosion Control**

All slopes and drainage areas should be designed with proper regard for the desired natural ground cover and growth regeneration on areas opened during construction. Various acceptable methods of erosion control, including seeding and mulching of slopes, sodding, or other protection of swales and other erodible areas, should be included in the local road design. Consideration should also be given to maintenance requirements and overall economics.

In roadside design, the preservation of natural ground covers and desirable growth of shrubs and trees should be considered, provided that such growth does not constitute an obstruction in the recovery area.

**ADA Guidelines – See Chapter 16 of the SDDOT Road Design Manual.**

## **REFERENCES**

1. AASHTO. *Guide for the Development of Bicycle Facilities*, Washington, D.C.: AASHTO, 1999.
2. AASHTO. *Standard Specifications for Highway Bridges*, Washington, D.C.: AASHTO, 2002.
3. AASHTO. *Roadside Design Guide*, Washington, D.C.: AASHTO, 2002.

4. U.S. Department of Transportation, Federal Highway Administration.  
*Manual on Uniform Traffic Control Devices for Streets and Highways*,  
Washington, D.C.: 2003 or most current edition.

## RURAL COLLECTORS

### Design Traffic Volumes

Rural collector highways should be designed for a specific traffic volume and specified acceptable levels of service. Usually, the design year is 20 years from the date of construction completion but may be any number of years within a range from the present (for restoration projects on existing roads) to 20 years in the future (for new construction projects).

The average daily traffic (ADT) volume for the design year should serve as the basis for the project design.

### Design Speed

Geometric design features should be consistent with a design speed appropriate for the conditions. Low design speeds of 45 mph and below are generally applicable to highways with curvilinear alignment in rolling or mountainous terrain, or where environmental conditions dictate. High design speeds of 50 mph and above are generally applicable to highway in level terrain or where other environmental conditions are favorable. Exhibit 6-1 identifies minimum design speeds for rural collector roads as a function of the type of terrain and design traffic volumes. The designer should strive for higher values than those shown where specific safety concerns are present and costs are not prohibitive.

**Minimum Design Speeds for Rural Collectors**  
**Exhibit 6-1, page 422, AASHTO 2004.**

Type of terrain	Design speed (mph) for specified design volume (veh/day)		
	0 to 400	400 to 2000	over 2000
Level	40	50	60
Rolling	30	40	50
Mountainous	20	30	40

Note: Where practical, design speeds higher than those shown should be considered.

It is desired that a design speed of 50 mph be considered first in the design of Rural Collectors.

### Sight Distance

Stopping sight distance and passing sight distance are a direct function of the design speed. An eye height of 3.5 ft and an object height of 2.0 ft are used to determine stopping sight distance. An eye height of 3.5 ft and an

object height of 3.5 ft are used to determine passing sight distance. For further information on sight distance, see Exhibits 6-2 and 6-3 and the section on “Sight Distance” in Chapter 3 (*of the AASHTO Green Book*).

**Design Controls for Stopping Sight Distance and for Crest and Sag Vertical Curves**  
**Exhibit 6-2, page 422, AASHTO 2004.**

Design speed (mph)	Design stopping sight distance (ft)	Rate of vertical curvature, $K^a$ (ft%)	
		Crest	Sag
15	80	3	10
20	115	7	17
25	155	12	26
30	200	19	37
35	250	29	49
40	305	44	64
45	360	61	79
50	425	84	96
55	495	114	115
60	570	151	136

<sup>a</sup> Rate of vertical curvature,  $K$ , is the length of curve per percent algebraic difference in the intersecting grades (i.e.,  $K = L/A$ )

**Design Controls for Crest Verticals Based on Passing Sight Distance**  
**Exhibit 6-3, page 423, AASHTO 2004.**

Design speed (mph)	Design passing sight distance (ft)	Rate of vertical curvature, $K_a$ (ft/%)
20	710	180
25	900	289
30	1090	424
35	1280	585
40	1470	772
45	1625	943
50	1835	1203
55	1985	1407
60	2135	1628

<sup>a</sup> Rate of vertical curvature,  $K$ , is the length of curve per percent

## Grades

Exhibit 6-4 identifies suggested maximum grades for rural collectors in specific terrain and design conditions.

**Maximum Grades for Rural  
Collectors  
Exhibit 6-4, page 423, AASHTO  
2004.**

Type of terrain	Maximum grade (%) for specified design speed (mph)								
	20	25	30	35	40	45	50	55	60
Level	7	7	7	7	7	7	6	6	5
Rolling	10	10	9	9	8	8	7	7	6
Mountainous	12	11	10	10	10	10	9	9	8

Note: Short lengths of grade in rural areas, such as grades less than 500ft in length, one-way downgrades, and grades on low-volume rural collectors may be up to 2 percent steeper than the grades shown above.

## Alignment

The designer should provide the most favorable alignment as practical for rural collectors. Horizontal and vertical alignment should complement each other and should be considered in combination to achieve appropriate safety, capacity, and appearance for the type of improvement proposed. Topography, traffic volume and composition, and right-of-way conditions are controlling features. Abrupt changes in horizontal alignment should be avoided. Vertical curves should meet the sight distance criteria for the design speed. In addition, frequent opportunities for passing should be avoided, where practical. For further information, see the sections on “Horizontal Alignment” and “Vertical Alignment” in Chapter 3 (*of the AASHTO Green Book*).

## Cross Slope

Pavement cross slope should be adequate to provide proper drainage. Normally, cross slopes range from 1.5 to 2 percent for high-type pavements. High-type pavements are those that retain smooth riding qualities and good non-skid properties in all weather under heavy traffic volumes and loadings with little maintenance required.

Low-type pavements are those with treated earth surfaces and those with loose aggregate surfaces. A cross slope of 3 to 6 percent is desirable for low-type pavements. For further information, see the section on “Cross Slope” in Chapter 4 (*of the AASHTO Green Book*).

## Superelevation

Many rural collector highways have curvilinear alignments. A superelevation rate compatible with the design speed should be used. For rural collectors, superelevation should not exceed 12 percent. Where snow and ice conditions may be a factor, the superelevation rate should not exceed 8 percent. Superelevation runoff denotes the length of

highway needed to accomplish the change in cross slope from a section with the adverse crown removed to a fully superelevated section and vice versa. Adjustments in design runoff lengths may be needed to provide a smooth ride, surface drainage, and good appearance. The section on “Horizontal Alignment” in Chapter 3 (*of the AASHTO Green Book*) provides a detailed discussion on superelevation for appropriate design speeds.

Superelevation rates will be according to current SDDOT standards. As stated in the SDDOT Road Design Guide, because of South Dakota's weather conditions, the maximum permissible rate of superelevation is 6%. This will apply to all paved surface roads. The maximum permissible rate of superelevation on gravel surface roads will be 8%. If other conditions arise that warrant consideration of greater rates, these will be discussed on an individual basis.

### **Number of Lanes**

The number of lanes should be sufficient to accommodate the design volumes for the desired level of service. Normally, capacity conditions do not govern rural collector roads, and two lanes are appropriate. For further information, see the section on “Highway Capacity” in Chapter 2 (*of the AASHTO Green Book*).

### **Width of Roadway**

For high-type surfaces, the minimum roadway width is the sum of the traveled way and shoulder widths shown in Exhibit 6-5. Shoulder width is measured from the edge of the traveled way to the point of intersection of shoulder slope and foreslope. Where roadside barriers are included, a minimum offset of 4 ft from the traveled way to the barrier should be provided, wherever practical. For further information see the sections on “Shoulders” and “Longitudinal Barriers” in Chapter 4 (*of the AASHTO Green Book*) and the section in Chapter 3 (*of the AASHTO Green Book*) on “Traveled Way Widening on Horizontal Curves” for vehicle offtracking information.

**Minimum Width of Traveled Way and Shoulders**  
**Exhibit 6-5, page 425, AASHTO 2004.**

US Customary				
Design speed (mph)	Minimum width of traveled way (ft) for specified design volume (veh/day) <sup>a</sup>			
	under 400	400 to 1500	1500 to 2000	over 2000
20	20 <sup>b</sup>	20	22	24
25	20 <sup>b</sup>	20	22	24
30	20 <sup>b</sup>	20	22	24
35	20 <sup>b</sup>	22	22	24
40	20 <sup>b</sup>	22	22	24
45	20	22	22	24
50	20	22	22	24
55	22	22	24	24
60	22	22	24	24
All speeds	Width of shoulder on each side of the road (ft)			
	2.0	5.0 <sup>c</sup>	6.0	8.0

<sup>a</sup> On roadways to be reconstructed, a 22-ft traveled way may be retained where the alignment and safety records are satisfactory.

<sup>b</sup> A 18-ft minimum width may be used for roadways with design volumes under 250 veh/day.

<sup>c</sup> Shoulder width may be reduced for design speeds greater than 30 mph as long as a minimum roadway width of 30 ft is maintained.  
 See text for roadside barrier and offtracking considerations.

## **Foreslopes**

The maximum rate of foreslope should depend on the stability of local soils as determined by soil investigation and local experience. Slopes should be as flat as practical, taking into consideration other design constraints. Flat foreslopes improve safety by providing a maneuvering area in emergencies, are more stable than steep slopes, aid in the establishment of plant growth, and simplify maintenance work. Roadside barriers may be used where topography and right-of-way are restrictive and a need is justified.

Drivers who inadvertently leave the traveled way can often recover control of their vehicles if foreslopes are 1V:4H or flatter and shoulders and ditches are well rounded or otherwise made traversable. Such recoverable slopes should be provided where terrain and right-of-way conditions allow.

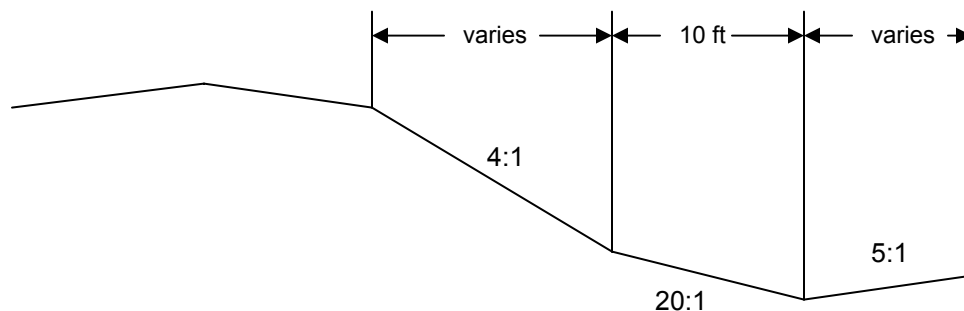
Where provision of recoverable slopes is not practical, the combinations of rate and height of slope provided should be such that occupants of an out-of-control vehicle have a good chance of survival. Where high fills, right-of-way restrictions, watercourses, or other problems render such designs impractical, roadside barriers should be considered, in which case the maximum rate of fill slope may be used. Reference should be made to the current edition of the *AASHTO Roadside Design Guide* (3). For further information, see the section on “Traffic Barriers” in Chapter 4 (of the *AASHTO Green Book*).

Cut sections should be designed with adequate ditches. Preferably, the foreslope should not be steeper than 1V:3H and, where practical, should be 1V:4H or flatter. The ditch bottom and slopes should be well rounded, and the backslope should not exceed the maximum needed for stability.

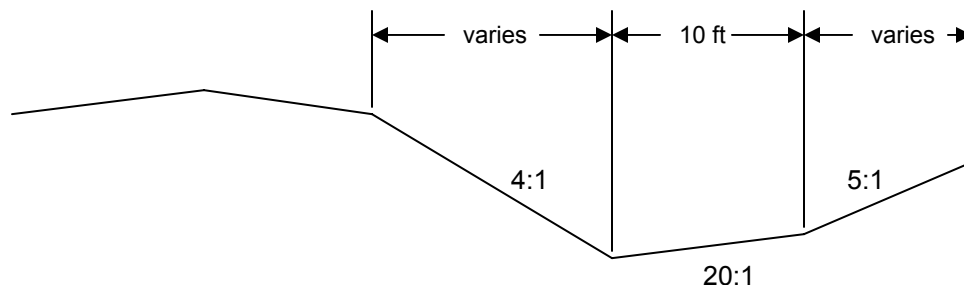
### Typical Cross Section

The typical section will include a crown slope of 0.03 ft/ft for gravel surfaces or 0.02 ft/ft for paved surfaces, 4:1 inslopes, 5:1 backslopes, and a standard 10' ditch at 20:1.

The following typical section keeps the ditch drainage farther from the roadway but requires larger work limits and potentially the need for more right-of-way.



The following typical section works well in areas where the project limits and impact to the right-of-way must be kept to a minimum.





## Surfacing

Surfacing shall be in accordance with current SDDOT standards. The basic minimums are noted in the table below.

Surfacing Design Minimums for a 20 Year Life Cycle		
ADT	Base	Surface
<400	8" to 10"	Asphalt Surface Treatment *
401 to 750	10"	3" Asphalt Concrete
>750	**	**
*Asphalt surface treatments need to be repeated @ every 4-5 years for optimum performance		
** Base and surface shall be designed according to current SDDOT Standards		

For gravel surfacing, the minimum thickness shall be 4" to 6". Design shall be in accordance with current SDDOT standards and the South Dakota Local Transportation Assistance Program's (SD LTAP) November 2000 *Gravel Roads Maintenance and Design Manual*.

## Resurfacing

Resurfacing projects will be designed according to current SDDOT standards.

Signing and marking will be in conformance with the current Manual on Uniform Traffic Control Devices (MUTCD). Particular attention will be given to the use of traffic control devices to assist in mitigating problems associated with substandard geometric features where the deficiency cannot be economically corrected.

At least three years of crash records will be evaluated by the LTP Local Government Section prior to proceeding with a resurfacing project under the resurfacing criteria. Crash history will be used to identify hazardous sites or point out situations where reconstruction to full standards should be considered. Resurfacing projects shall be constructed to preserve and extend the service life of existing highways, enhance highway safety, and provide an appropriate skid resistant surface.

## Structures

The design of bridges, culverts, walls, tunnels, and other structures should be in accordance with the current *AASHTO Standard Specifications for Highway Bridges (4)*, or with the *AASHTO LRFD Bridge Design Specifications (5)*. Except as otherwise indicated herein, the dimensional design of structures should also be in accordance with these standard specifications.

The minimum design loading for bridges on collector roads should be HS 20. The minimum roadway widths for new and reconstructed bridges should be as shown in Exhibit 6-6.

**Minimum Roadway Widths and Design Loadings for  
New and Reconstructed Bridges**  
Exhibit 6-6, page 426, AASHTO 2004.

Design volume (veh/day)	Minimum clear roadway width for bridges <sup>a</sup>	Design loading structural capacity
400 and under	Traveled way + 2 ft (each side)	HS 20
400 to 1500	Traveled way + 3 ft (each side)	HS 20
1500 to 2000	Traveled way + 4 ft (each side) <sup>b</sup>	HS 20
over 2000	Approach roadway (width) <sup>b</sup>	HS 20

<sup>a</sup> Where the approach roadway width (traveled way plus shoulders) is surfaced, that surface width should be carried across the structures.

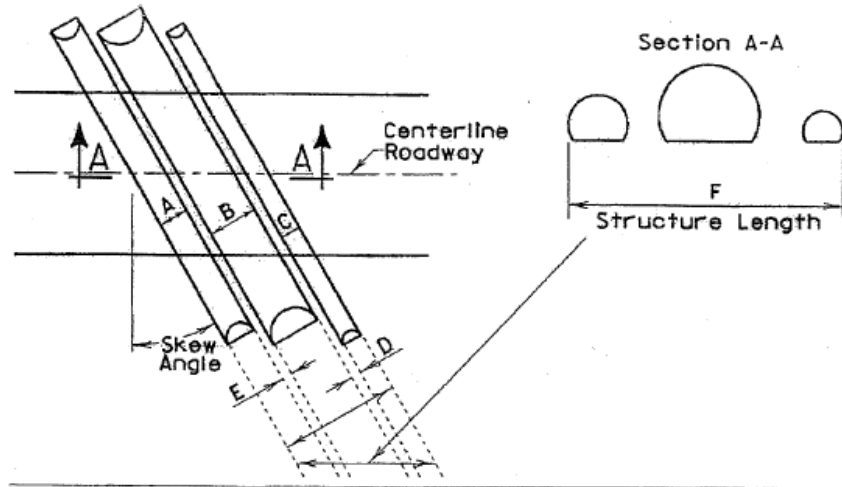
<sup>b</sup> For bridges in excess of 100ft in length, the minimum width of traveled way plus 3 ft on each side is acceptable.

## National Bridge Inventory System and SD Codified Law Definitions

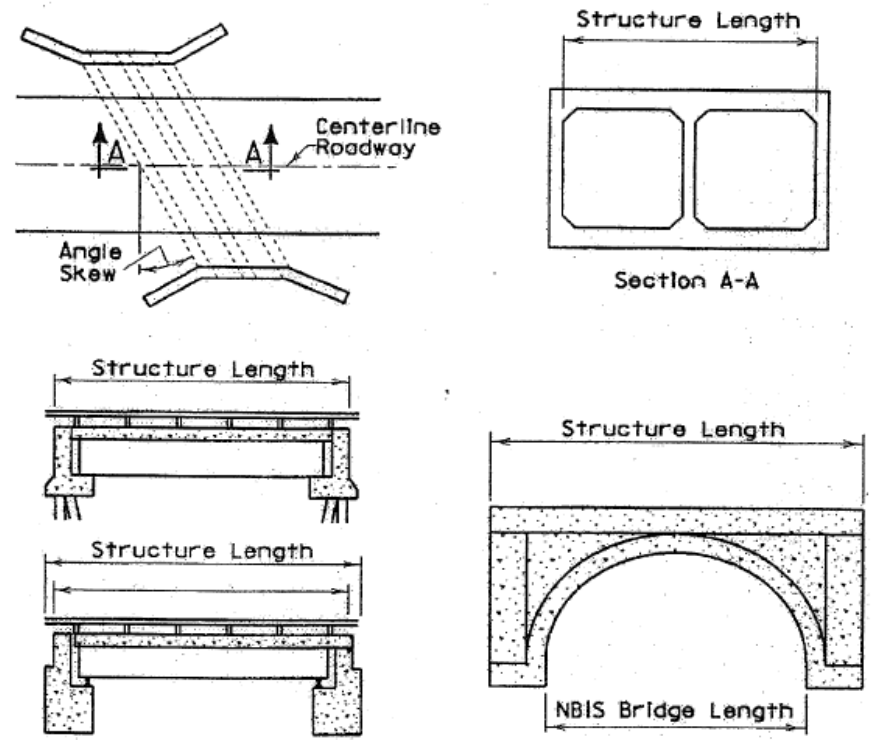
A structure is considered a bridge when its length, measured along the center of the roadway, is more than 20 feet from abutment to abutment, or extreme ends of openings for multiple boxes and pipes where the clear distance between the openings is less than half of the smaller opening. A structure is a culvert when it cannot be classified as a bridge and provides an opening under a

roadway. (SDCL 31-14-1) Culverts shall be no less than 24 feet in length.  
(SDCL 31-12-18)

**Diagram from "SD Bridge System Code Manual, 1998 Edition"**



Multiple pipes may be considered a bridge if the distance between the pipes is less than half the smallest opening and the structure length is greater than 6.1 meters (20 feet). In the above illustration, distance D and E must be less than half the distance C and distance F must be greater than 6.1 meters (20 feet) for these pipes to be a bridge.



## **Hydraulic Design Criteria**

Flood plain evaluation will be in accordance with 23 CFR 650A. Hydraulic design will normally be for the 10 year storm on Local Rural Road bridge replacement projects with an overflow section in the approach grade. If an overflow section does not exist within the approach grade, a 25 year storm should be used. Bridge replacement projects on Rural Collectors will normally be designed to pass the 25 year storm. If the ADT is less than 100, use the 10 year storm, unless an overflow section does not exist. Low water crossings will be designed using report #FHWA/RD-83/015, Design and Construction of Low Water Stream Crossings, as a guide. Typically the low water crossings are designed using a 2 year design frequency with 1.5 feet of overtopping depth. Scour design will be in accordance with Hydraulic Engineering Circular No. 18 (HEC-18) and riprap design will be in accordance with Hydraulic Engineering Circular No. 11 (HEC-11.)

At locations where the current structure functions hydraulically at a storm event less than those noted above, and extensive grading would be required to make the new structure meet these design storms, the county may request a design exception to maintain the current storm, on a project by project basis.

## **Bridge Rail**

Bridge rail end protection and bridge rail systems that have been crash tested in accordance with NCHRP 350 will be provided on Rural Collectors and Local Rural Roads with ADT's greater than 150. Rural Collectors and Local Rural Roads with ADT's less than 150 may have rail end treatments turned down 15° or flatter and rail systems designed in accordance with NCHRP 350 Test Level 2 or better design criteria. The LTP Local Government Section maintains details for several rail systems that meet the criteria noted. These details also address the type and length of approach rail if applicable.

Rail designs that may be needed for special conditions (i.e. an approach or intersection located within such close proximity to a structure as to interfere with the standard rail placement, rehabilitation of existing rail, etc.) will be in accordance with current SDDOT guidelines.

## Bridges to Remain in Place

Because highway geometric and roadway improvements may encourage higher speeds and attract larger vehicles, existing structures also should be improved correspondingly. Because of their high cost, reasonably adequate bridges and culverts that meet tolerable criteria may be retained.

Where an existing highway is to be reconstructed, an existing bridge that fits the proposed alignment and profile may remain in place when its structural capacity in terms of design loading and roadway width are at least equal to the values shown for the applicable traffic volume in Exhibit 6-7.

The values in Exhibit 6-7 do not apply to structures with a total length greater than 100 ft. Such structures should be analyzed individually by taking into consideration the clear width provided, crash history, traffic volumes, remaining life of the structure, design speed, and other pertinent factors.

### Structural Capacities and Minimum Roadway Widths for Bridges to Remain in Place

Exhibit 6-7, page 427, AASHTO 2004.

Design volume (veh/day)	Design loading structural capacity	Minimum clear roadway width (ft) <sup>a</sup>
under 400	H 15	22
400 to 1500	H 15	22
1500 to 2000	H 15	24
over 2000	H 15	28

<sup>a</sup> Clear width between curbs or railings, whichever is less, should be equal to or greater than the approach traveled way width, wherever practical.

## Vertical Clearance

Vertical clearance at underpasses should be at least 14 ft over the entire roadway width, with an additional allowance for future resurfacing.

## Horizontal Clearance to Obstructions

For rural collector roads with a design speed of 45 mph or less, a minimum clear zone of 10ft measured from the edge of the traveled way should be provided. This recovery area should be clear of all unyielding objects such as trees, sign supports, utility poles, light poles, and other fixed objects. The benefits of removing these obstructions should be weighed against any environmental and aesthetic effects.

For rural collector roads with a design speed of 50 mph or more, the *AASHTO Roadside Design Guide (3)* should be used for guidance in selecting an appropriate clear-zone width.

Guidance can also be found in Chapter 10 of the SDDOT Road Design Manual.

The approach roadway width (traveled way plus shoulders) should be carried across an overpass or bridge, where practical. Approach roadside barriers, anchored to the bridge rails or parapets, should be provided. Sidewalks should extend across a bridge if the approach roadway has sidewalks or sidewalk areas. To the extent practical, where another highway or railroad passes over the roadway, the overpass structure should be designed so that the pier or abutment supports have lateral clearance as great as the clear zone on the approach roadway. Where a setback beyond the clear zone is not practical, roadside barrier protection should be provided at the piers.

### **Transverse Pipe End Treatments**

End treatments for mainline (transverse) pipe will follow the guidelines in Chapter 10 of the SDDOT Road Design Manual.

### **Mailbox and Newspaper Container Guidance**

Installation of mailboxes and newspaper containers will be in accordance with current SDDOT guidelines. Acceptable support systems shall be used that have been accepted by the Federal Highway Administration (FHWA) based on crash test results.

### **Right-of-Way Width**

The provision of right-of-way widths that accommodate construction, adequate drainage, and proper maintenance of a highway is an important part of the overall design. Wide rights-of-way permit the construction of gentle slopes, resulting in greater safety for the motorist and provide for easier and more economical maintenance. The acquisition of sufficient right-of-way, at the time of initial construction, permits subsequent widening of the roadway and the widening and strengthening of the pavement at a reasonable cost as traffic volumes increase.

In developed areas it may be desirable to limit the right-of-way width. However, the right-of-way width should not be less than that needed for all

elements of the design cross section, utility accommodation, and appropriate border areas.

### **Intersection Design**

Intersections should be carefully located to avoid steep profile grades and to ensure adequate approach sight distance. An intersection should not be situated just beyond a sharp crest vertical curve or on a sharp horizontal curve. Where there is no practical alternative to such a location, the approach sight distance on each leg should be checked and, where practical, backslopes should be flattened and horizontal or vertical curves lengthened, to provide additional sight distance. The driver of a vehicle approaching an intersection should have an unobstructed view of the entire intersection and sufficient lengths of the intersecting roadway to permit the driver to anticipate and avoid potential collisions. Sight distances at intersections with six different types of traffic control cases are presented in Chapter 9 (*of the AASHTO Green Book*).

Intersections should be designed with a corner radius for pavement or surfacing adequate for the larger vehicles anticipated; for information on minimum edge radius, see Chapter 9 (*of the AASHTO Green Book*). Where turning volumes are substantial speed-change lanes and channelization should be considered.

Intersection legs that operate under stop sign control should intersect at right angles, wherever practical, and should not intersect at an angle less than 60 degrees. For more information on intersection angle, see Chapter 9 (*of the AASHTO Green Book*).

A stopping area that is as level as practical should be provided for approaches on which vehicles may be required to stop.

### **Railroad-Highway Grade Crossings**

Appropriate grade crossing warning devices should be installed at all railroad-highway grade crossings on collector roads and streets. Details of the devices to be used are given in the *Manual on Uniform Traffic Control Devices (MUTCD) (6)*. In some states, the final approval of these devices may be vested in an agency having oversight over railroads.

In South Dakota the final approval of these devices is determined as a joint decision between the agency having jurisdiction over the particular road and the applicable railroad.

Sight distance is an important consideration at railroad-highway grade crossings. There should be sufficient sight distance along the road for an approaching driver to recognize the railroad crossing, perceive the warning device, determine whether a train is approaching, and stop if necessary. Adequate sight distance along the track is needed for drivers of stopped vehicles to decide when it is safe to proceed across the tracks. For further information on railroad-highway grade crossings, see Chapter 9 (*of the AASHTO Green Book*).

The roadway width at railroad crossings should be the same as the width of the approach roadway. Crossings that are located on bicycle routes that are not perpendicular to the railroad may need additional paved shoulder width for bicycles to maneuver over the crossing. For further information, see the *AASHTO Guide for the Development of Bicycle Facilities* (2).

### **Traffic Control Devices**

Traffic control devices should be applied consistently and uniformly. Details for the standard traffic control devices and warrants for various conditions are found in the *MUTCD* (6). Geometric design of rural collectors should include full consideration of the types of traffic control to be used, especially at intersections where multi-phase or actuated traffic signals are likely to be needed. For further information, see the section on “Traffic Control Devices” in Chapter 3 (*of the AASHTO Green Book*).

Chapter 31-28-11 of the South Dakota Codified Laws states that on any street or road constructed with federal aid, all traffic control devices shall conform to uniform national signing standards. These standards can be found in the *MUTCD*.

### **Erosion Control**

Design of rural collectors should consider preservation of the natural ground cover and desirable growth of shrubs and trees within the right-of-way. Shrubs, trees, and other vegetation should be considered in assessing the driver’s sight line and the clear recovery distance. Seeding, mulching, sodding, or other acceptable measures for covering slopes, swales, and other erodible areas should also be considered in the rural collector design. For further information, see the section on “Erosion Control and Landscape Development” in Chapter 3 (*of the AASHTO Green Book*).

**ADA Guidelines – See Chapter 16 of the SDDOT Road Design Manual.**



## REFERENCES

2. AASHTO. *Guide for the Development of Bicycle Facilities*, Washington, D.C.: AASHTO, 1999.
3. AASHTO. *Roadside Design Guide*, Washington, D.C.: AASHTO, 2002.
4. AASHTO. *Standard Specifications for Highway Bridges*, Washington, D.C.: AASHTO, 2002.
5. AASHTO. *LRFD Bridge Design Specifications*, 3rd edition, Washington, D.C.: AASHTO, 2004.
6. U.S. Department of Transportation, Federal Highway Administration. *Manual on Uniform Traffic Control Devices for Streets and Highways*, Washington, D.C.: 2003 or most current edition.

**LOCAL ROADS PLAN**  
**SECTION II – CITY SPONSORED PROJECTS**

**GENERAL INFORMATION**

**1. AUTHORITY AND APPLICABILITY**

Section II of the "Local Roads Plan" (hereinafter referred to as the "Plan") is a written statement setting forth the standards and procedures to be followed in location, design, construction, and administration of work on the Federal-aid System, under the jurisdiction of the cities, and on applicable roads not on the Federal-aid System. The goal of the South Dakota Department of Transportation (SDDOT) is to permit maximum flexibility and encourage local initiative and cooperation in selecting, developing and constructing projects under the Plan.

The SDDOT will administer projects financed with Surface Transportation Program (STP) funds on roads functionally classified, as per 23 U.S.C. section 133 (Federal-aid System), under the provisions of this Plan. Where Federal-aid is made available for projects not on the Federal-aid System, the SDDOT will administer those projects under this Plan when Federal regulation permits. All phases of project activity will be accomplished in accordance with this Plan and applicable Federal requirements.

The SDDOT will administer projects financed with the Highway Bridge Replacement and Rehabilitation Program (HBRRP) funds on bridges both on and off of the Federal-aid highways, as per 23 U.S.C. section 144 and 23 CFR Part 650 subpart D. Where Federal-aid is made available for projects not on the Federal-aid System, the SDDOT will administer those projects under this Plan when Federal regulation permits. All phases of the project activity will be accomplished in accordance with this Plan and applicable Federal requirements.

Authority under the Plan extended from FHWA to the SDDOT does not include FHWA responsibilities under the National Environmental Policy Act of 1969, Section 138 of Title 23, Title VI of the Civil Rights Act of 1964, Title VIII of the Civil Rights Act of 1968 as amended in 1974, and the Uniform Relocation

Assistance and Land Acquisition Policies Act of 1970 (as amended) and 49 CFR Part 24.

Provisions of Section II of the Plan are applicable only to projects sponsored by the cities or other local political subdivisions in cooperation with the applicable city. Projects not included under this Plan are:

- Railroad crossing projects not on the Federal-aid System
- Projects in cities of populations greater than 5000, not on the Federal-aid System.

Legal authority creating the SDDOT, permitting compliance with Title 23 USC, establishing the Federal-aid System and providing standards, specifications and assistance to the cities is contained in SDCL, Chapter 31-1, 31-2, 31-5 and 31-6.

## **2. DEPARTMENT OF TRANSPORTATION, LOCAL TRANSPORTATION PROGRAMS, LOCAL GOVERNMENT SECTION**

The Local Government Section staff within the Office of Local Transportation Programs (LTP), SDDOT, and under the direction of the LTP Program Manager, will be responsible for administration of projects under Section II of the Plan. Advice, consultation and recommendations are available from all sections within the SDDOT and will be requested and coordinated by the LTP Program Manager.

The primary function of the LTP Local Government Section is to provide the cities with information and guidance on all phases of the Plan on a continuous basis and assure compliance with all Federal and State requirements. Cooperation with local government officials will be continuous during project selection, development and construction.

The Region Engineer will be responsible for the construction administration of the projects.

## **3. ALLOTMENT OF FUNDS**

STP Funds are sub-allocated to the cities, and are divided, based on population, among cities greater than 5000 in population. Authority for apportionment of funds is by action of the SDDOT Transportation Commission,

as of October 8, 1965. City officials will be advised of their STP Fund balance annually.

#### **4. PROJECT SELECTION AND PUBLIC INVOLVEMENT**

Projects will be selected by City Councils in cooperation with the SDDOT and other appropriate local officials. The city is the political entity that will be held responsible by SDDOT for all required documents, actions and functions during project development, construction and for required future project maintenance.

Public and interagency involvement and consideration of social, economic and environmental effects will be processed in accordance with SDDOT Public Involvement/Public Hearing Process, Paragraph E Section I and applicable portions of Section II, III and IV and with 23 CFR 771. SDDOT will provide assistance to the cities in assuring compliance with Public Involvement Procedures. The environmental classification will be submitted at an appropriate time after program submission for concurrence by the FHWA except for projects that require significant right-of-way, 404 permits, wetland findings, 4(f) statements, Environmental Assessments or Environmental Impact Statements. These projects will require an individual environmental classification approved by FHWA prior to advertising for bids.

All projects requiring acquisition of significant amounts of right-of-way, temporary easements or that substantially change the layout or function of connecting roads or have a significant adverse impact on abutting property or have significant environmental impact will require a public hearing, or public meeting providing a Notice of Opportunity for Public Hearing in accordance with the SDDOT Public Involvement/Public Hearing Process.

#### **5. PROGRAMMING, AUTHORIZATION AND SYSTEM REVISION**

The annual statewide program of city sponsored projects will be submitted as part of the Statewide Transportation Improvement Program (STIP) to the FHWA for approval before the first of October. Project requests in resolution form should be submitted by the City Councils prior to the first of April each year for consideration and approval by the SDDOT and inclusion in the annual

program. A supplemental program or programs may be submitted if required, depending on need.

Selection of the Federal-aid System shall be accomplished cooperatively by the SDDOT and appropriate local officials. Revision of the city street portion of the Federal-aid System shall be by request of the City Councils in resolution form subject to approval of the SDDOT and the FHWA. System revision will be accomplished in accordance with 23 CFR.

## **6. PRELIMINARY ENGINEERING**

Survey, design and plan preparation will be accomplished by the city, consulting engineering firms, or the SDDOT. Agreements for engineering services by consultants with Federal participation will be in accordance with 23 CFR 172 and the SDDOT Policy for Procuring Consultant Engineering Services.

Project plans will be reviewed by the city, LTP Local Government Section, Region Engineer, Area Engineer, applicable central offices within the SDDOT, and FHWA if applicable.

Review of hydraulics, foundations, materials, surfacing, construction and permanent traffic signing, or recommendations as applicable, will be provided by the SDDOT on all projects. Economic studies will be provided by the SDDOT if required, or upon request on all projects.

When required, Section 404 permits will be obtained by the SDDOT and required contract provisions included in the contract proposal.

Where projects include unusual or complex bridges, bridges that are estimated to cost over \$5 million or have other unusual features, preliminary plans will be submitted to FHWA for review and technical guidance.

Project plans will be approved by the LTP Local Government Section prior to scheduling for letting.

The South Dakota Standard Specifications for Roads and Bridges (latest edition), Supplemental Specifications, Special Provisions, and required contract provisions as applicable, will be made a part of the contract documents on all projects. Standard title and typical plan sheets for most all types of work are

available and will be used to the maximum extent practicable to provide uniformity and economy.

## **7. CONSTRUCTION - CONTRACT**

Projects will be let to contract by the SDDOT in accordance with 23 CFR 635 and South Dakota State Law. Contract award will be made by the State Transportation Commission subject to concurrence by the City Councils.

Adequate justification will be formally documented and retained in the project file when bids are substantially higher than the engineers estimate, are unusual or have substantial variations. The guidelines included in the FHWA 'Guidelines on Preparing Engineer's Estimate, Bid Reviews and Evaluation' (which replaces FHWA Technical Advisories TA T 5080.4 and 5080.6) will be used to evaluate bids received. Where the low bid does not meet the guidelines and the city desires to award the contract as bid, justification will be submitted to SDDOT. Where the low bid does meet the guidelines and the city desires to reject all bids, justification will be submitted to SDDOT.

Construction engineering will be provided on all projects in accordance with current operating policy as defined by policy letters and procedures issued by the SDDOT Operations Division. Project supervision will be at the direction of the SDDOT Area Engineer. All projects will be constructed in accordance with current South Dakota Standard Specifications for Roads and Bridges. Quality control, sampling, testing and material certification will be performed in accordance with the SDDOT Materials Manual.

Approval authority for routine construction change orders rests with the Region Engineer and the City Engineer. Construction change orders shall be prepared and processed in accordance with the Division of Operation's current policies concerning construction change orders.

Construction change orders that involve a change in the scope of the work or substantial cost increase (greater than 20% over the total project cost), as determined by the Region Engineer and the City Engineer, will be reviewed with the LTP Local Government Section prior to approval. Approval of the construction change orders will be in accordance with the Division of Operation's

current policies concerning construction change orders. In the event that the change in scope is significant or involves work beyond the project termini, a re-evaluation of the environmental document shall be coordinated with the SDDOT Environmental Office.

## **8. RIGHT-OF-WAY**

Appraisals will be the responsibility of the city and may be accomplished by the Director of Equalization, staff appraisers or fee appraisers. The LTP Local Government Section, as assisted by Right-of-Way Program personnel, will review the appraisals and supervise right-of-way acquisition procedures. The negotiation process will be the responsibility of a qualified individual within the city. Relocation Assistance, if required, will be accomplished by Right-of-Way Program personnel within the SDDOT upon request by the LTP Local Government Section. Prior to advertising of contracts the FHWA Division Administrator will be furnished a Right-of-Way Certification on all projects to assure compliance with applicable provisions of Right-of-Way Directives and approved procedures.

Appendix 2 contains a detailed description of the right-of-way acquisition procedure. The required, pre-approved, right-of-way forms can be requested from the LTP Local Government Section at any time.

The city may request the SDDOT Right-of-Way Office to perform appraisals, review appraisals, negotiations, and acquisitions on behalf of the city on a case-by-case basis. Condemnation proceedings are handled by the city.

## **9. UTILITY ADJUSTMENTS**

Adjustment of Utilities and Railroads will be in accordance with South Dakota State Law and 23 CFR 645A. The city is responsible for utility notification and coordinating any utility relocation work. Assistance can be requested of the Utility Coordinator of the SDDOT Project Development Office.

Utility facilities will be adjusted or removed from the right-of-way in cases where they constitute a safety hazard. Minimum lateral clearances as shown in the 'Design Criteria for Urban Roads' section of this document, as applicable, may be allowed on a project by project basis considering traffic volume, right-of-

way width, removal cost and location. Exceptions to these criteria shall be approved by the LTP Program Manager.

#### **10. SAFETY PROGRAM**

A continuing safety improvement effort will be provided to local officials by all elements of the SDDOT using Safety Funds and normal Federal-aid Funds. Areas receiving priority and emphasis are design standards, individual project design, permanent traffic signing, construction signing, pavement marking, removal of roadside obstacles, elimination of deficient bridges, stand alone rumble strips, and rumble stripes.

The SDDOT Traffic Safety Engineer is available to provide safety related services to local agencies upon request. Typical services available include traffic control signing recommendations, intersection geometrics recommendations, crash data, cost-benefit studies for proposed safety projects, and Road Safety Audit Reviews.

#### **11. ACCOUNTING PROCEDURES AND GUIDE COMPLIANCE**

Accounting control and current billing will be in accordance with procedures established through the FHWA Stewardship agreements and through the SDDOT Finance Office.

Audits and Internal Review will evaluate selected projects and activities for Plan compliance. Reports of review, deficiencies and corrective actions will be furnished to Office Supervisors, Division Directors, Region Engineers, applicable Program Managers, Area Engineers, FHWA and local officials.

Assurance of compliance by local officials with existing and subsequent Federal or State Laws and requirements will be provided by the LTP Local Government Section by continuous review of all phases of each project. Changes in the current Plan or policy will be provided by the LTP Local Government Section by direct mailing and will be discussed at various State, Area, and local government meetings.



## **12. USE OF STANDARD FORMS, AGREEMENTS AND CERTIFICATES**

The following standard forms will be used on all projects as applicable. Forms will be revised as necessary to comply with future changes in Federal or State Laws and regulations.

- Program Resolution (includes Maintenance Agreement acknowledgment)

- Urban Programming Document

- Funding Agreement

- Design Sheets

- Public Hearing Standard Forms

- Utilities Certificate

- Right-of-Way Certificate

- All Right-of-Way Acquisition Forms

- Letting Authorization

- Encroachment Survey

All forms are available from the LTP Local Government Section.

## **13. FINAL INSPECTION AND ACCEPTANCE**

A final inspection will be made of each completed project by a representative of the applicable local authority and the Region Engineer. The Region Engineer will furnish notification of final inspection and acceptance to the Division of Operations.

The Division of Operations will furnish the notification of project completion to the FHWA. All project records and documents will be available for review and inspection by FHWA officials at all times during project development and construction, and will be retained and available as per 23 CFR 17 for review and inspection for a three year period after payment of the final voucher to FHWA for the project.

## **14. EVALUATION AND REVISION**

The Plan will be revised as required by changes in SDDOT operation, significant changes in the 2004 edition of the AASHTO publication, "A Policy on Geometric Design of Highways and Streets and 2001 edition of the AASHTO publication, "Guidelines for Geometric Design of Very Low-Volume Local Roads

(ADT  $\leq$  400), where review has shown change to be desirable, or due to changes in applicable Federal and State Laws, orders and directives. Revisions of the Plan documented, dated and issued to local officials. Changes of the Plan may be initiated by the counties or the South Dakota Department of Transportation, through the LTP Local Government Section.

#### **15. ADMINISTRATION OF HIGHWAY BRIDGE REPLACEMENT AND REHABILITATION PROGRAM**

23 CFR 650D (Highway Bridge Replacement and Rehabilitation Program) provides for administration of bridge replacement and rehabilitation projects under provisions of the approved Plan.

Bridge replacement and rehabilitation projects, both on and off the Federal-aid System, sponsored by a county or other local political subdivision including cities, will be administered in accordance with this Plan. Design standards will be in accordance with the Design Criteria sections of this document.

Special Bridge Replacement and Rehabilitation Funds apportioned to the State of South Dakota are divided as follows: fifty percent (50%) is made available to the cities and counties and fifty percent (50%) is retained by the State. The 50% made available to cities and counties is available for eligible projects on a statewide basis with sufficiency rating of the structure a significant consideration in prioritizing project requests that are submitted. Not less than 30% or more than 70% of the funds made available to the cities and counties shall be expended for projects located on public roads other than those on the Federal-aid System.

#### **16. DESIGN CRITERIA**

Design criteria will be in accordance with the 2004 edition of the AASHTO publication, "A Policy on Geometric Design of Highways and Streets," referred to in this publication as 'AASHTO Green Book.' Projects on the Federal-aid System under the jurisdiction of the cities will be designed to meet the criteria found in Chapter 6, Collector Roads and Streets, and in Chapter 7, Rural and Urban Arterials. Projects not on the Federal-aid System will be designed to meet the

criteria found in Chapter V, Local Roads and Streets. Most of this information is reproduced within the 'Design Criteria for Urban Roads' section of this document within paragraphs of indented and single-spaced format. To maintain uniformity, exhibit and reference numbers have not been changed from those shown in the AASHTO Green Book. All exhibits in the body of the Plan are in English units and any chapters referenced are as found in the AASHTO Green Book.

Design criteria for local roads with ADT of  $\leq 400$  is included in this document and will be in accordance with the 2001 edition of the AASHTO publication, "Guidelines for Geometric Design of Very Low-Volume Local Roads (ADT  $\leq 400$ )", referred to in this document as 'AASHTO Low Volume Guide.' Appendix 1 contains this information reproduced from Chapter 4, Design Guidelines, of the AASHTO Low Volume Guide. To maintain uniformity, exhibit and reference numbers have not been changed from those shown in the AASHTO Low Volume Guide. All exhibits in Appendix 1 are in English units and any chapters referenced are as found in the AASHTO Low Volume Guide.

The best possible design should be selected considering safety, existing and future needs, economy, reasonable maintenance costs and available funding. In restricted areas, or where there are other unusual considerations, it may not be possible to meet all minimum design values. Exceptions to applicable design criteria will be considered upon request by the city on a project by project basis when in the public interest and subject to approval by the SDDOT.

## **DESIGN CRITERIA FOR URBAN ROADS**

### **URBAN COLLECTORS**

#### **Design Traffic Volume**

Traffic volumes are a major factor in determining the geometric criteria to be used in designing urban collector streets. Specifically, the design traffic volumes projected to some future design year should be the basis of design. It usually is difficult and costly to modify the geometric design of an existing collector street unless provisions are made at the time of initial

construction. The design traffic should be estimated for at least 10 and preferably 20 years from the anticipated completion of construction.

### Design Speed

Design speed is a factor in the design of collector streets. For consistency in design, a design speed of 30 mph or higher should be used for urban collector streets, depending on available right-of-way, terrain, adjacent development, likely pedestrian presence, and other site controls. See Exhibit 6-1 and the section on “Design Speed” in Chapter 2 (*of the AASHTO Green Book*) for additional information.

Please note that even though the following Exhibit 6-1 refers to Rural Collectors, the intent, as stated above, is that the exhibit applies to Urban Collectors as well.

**Minimum Design Speeds for Rural Collectors**  
**Exhibit 6-1, page 422, AASHTO 2004.**

Type of terrain	Design speed (mph) for specified design volume (veh/day)		
	0 to 400	400 to 2000	over 2000
Level	40	50	60
Rolling	30	40	50
Mountainous	20	30	40

Note: Where practical, design speeds higher than those shown should be considered.

In the typical urban street grid, closely spaced intersections often limit vehicular speeds and thus make the consideration of design speed of lesser significance. Nevertheless, the longer sight distances and curve radii commensurate with higher design speeds result in safer highways and should be used to the extent practical.

### Sight Distance

Stopping sight distance for urban collector streets varies with design speed. Design for passing sight distance seldom is applicable on urban collector streets. For further information, see Exhibits 6-2 and 6-3 and the section on “Sight Distance” in Chapter 3 (*of the AASHTO Green Book*).

**Design Controls for Stopping Sight Distance and for Crest and Sag Vertical Curves  
Exhibit 6-2, page 422, AASHTO 2004.**

Design speed (mph)	Design stopping sight distance (ft)	Rate of vertical curvature, K <sup>a</sup> (ft%)	
		Crest	Sag
15	80	3	10
20	115	7	17
25	155	12	26
30	200	19	37
35	250	29	49
40	305	44	64
45	360	61	79
50	425	84	96
55	495	114	115
60	570	151	136

<sup>a</sup> Rate of vertical curvature, K, is the length of curve per percent algebraic difference in the intersecting grades (i.e.,  $K = L/A$ )

**Design Controls for Crest Verticals Based on Passing Sight Distance  
Exhibit 6-3, page 423, AASHTO 2004.**

Design speed (mph)	Design passing sight distance (ft)	Rate of vertical curvature, K <sub>a</sub> (ft/%)
20	710	180
25	900	289
30	1090	424
35	1280	585
40	1470	772
45	1625	943
50	1835	1203
55	1985	1407
60	2135	1628

<sup>a</sup> Rate of vertical curvature, K, is the length of curve per percent

## Grades

Grades for urban collector streets should be as level as practical, consistent with the surrounding terrain. A minimum grade of 0.30 percent is acceptable to facilitate drainage. However, it is recommended that a grade of 0.50 percent grade or more be used, where practical, for drainage purposes. Where adjacent sidewalks are present, a maximum grade of 5 percent is recommended to meet the *Americans with Disabilities Act Accessibility Guidelines (ADAAG)* and other applicable criteria, where terrain conditions permit (7, 8.) The grade of an urban street is generally depressed below the surrounding terrain to direct drainage from adjacent property to the curb area so that it can reach the

storm drain system. Applicable gradients, vertical curve lengths, and other pertinent features are discussed in the section on “Vertical Alignment” in Chapter 3 (*of the AASHTO Green Book*). Maximum grades for urban collector streets should be as presented in Exhibit 6-8.

#### **Maximum Grades for Urban Collectors**

**Exhibit 6-8, page 432, AASHTO 2004.**

Type of terrain	Maximum grade (%) for specified design speed (mph)								
	20	25	30	35	40	45	50	55	60
Level	9	9	9	9	9	8	7	7	6
Rolling	12	12	11	10	10	9	8	8	7
Mountainous	14	13	12	12	12	11	10	10	9

Note: Short lengths of grade in urban areas, such as grades less than 500 ft in length, one-way downgrades, and grades on low-volume urban collectors may be up to 2 percent steeper than the grades shown above.

### **Alignment**

Alignment in residential areas should fit closely the existing topography to minimize the need for cuts or fills without sacrificing safety.

### **Cross Slope**

Pavement cross slope should be adequate to provide proper drainage. Cross slope should normally be from 1.5 to 3 percent where there are flush shoulders adjacent to the traveled way or where there are outer curbs.

### **Superelevation**

Superelevation, in specific locations, may be advantageous for urban collector street traffic operation. However, in built-up areas, the combination of wide pavement areas, proximity of adjacent development, control of cross slope, profile for drainage, frequency of cross streets, and other urban features often combine to make its use impractical or undesirable. Where used, superelevation on urban collector streets should be 6 percent or less. The absence of superelevation on urban collectors for low speeds of 45 mph and below generally is not detrimental to the motorist. Often, some warping or partial removal or reversal of the tangent pavement crown may facilitate operations. When warping or removing the pavement crown, drainage should be considered. For further information, see the sections on “Horizontal Alignment” and “Design for Low-Speed Urban Streets” in Chapter 3 (*of the AASHTO Green Book*).

## **Number of Lanes**

Two moving traffic lanes plus additional width for shoulders and parking are sufficient for most urban collector streets. Where the street is developed in stages, initially a rural cross section with shoulders may be used. The street should be planned for later conversion of the shoulder width to a parking lane or a through lane, usually with outer curbs. Where the initial development utilizes a rural cross section, a clear zone consistent with rural conditions and commensurate with the design speed should be provided. When the conversion of the shoulder occurs, the clear zone can be modified to that appropriate for urban conditions. If practical and economically feasible, the initial construction should be four lanes with curbs, allowing parking on the two outer lanes until later development necessitates the use of all four lanes for traffic movement.

In some cases, in commercial areas where there are midblock left turns, it may be advantageous to provide an additional continuous two-way left-turn lane in the center of the roadway.

The number of lanes to be provided on urban collector streets with high traffic volumes should be determined from a capacity analysis. This analysis should consider both intersections and midblock locations, when appropriate, in assessing the ability of a proposed design to provide the desired level of service. Such analyses should be made for the future design year traffic volume utilizing the procedures in the most recent edition of the *Highway Capacity Manual* (1.) For further information, see the section on "Highway Capacity" in Chapter 2 (of the *AASHTO Green Book*).

## **Width of Roadway**

The width of an urban collector street should be planned as the sum of the widths of the ultimate lanes for moving traffic, parking, and bicycles, including median width where appropriate.

Lanes within the traveled way should range in width from 10 to 12 ft. In industrial areas, lanes should be 12 ft wide except where lack of space for right-of-way imposes severe limitations; in such cases, lane widths of 11 ft may be used. Added turning lanes at intersections, where used, should range in width from 10 to 12 ft, depending on the percentage of trucks. Where shoulders are used, roadway widths should be determined by referring to Exhibit 6-5.

**Minimum Width of Traveled Way and Shoulders**  
**Exhibit 6-5, page 425, AASHTO 2004.**

US Customary				
Design speed (mph)	Minimum width of traveled way (ft) for specified design volume (veh/day) <sup>a</sup>			
	under 400	400 to 1500	1500 to 2000	over 2000
20	20 <sup>b</sup>	20	22	24
25	20 <sup>b</sup>	20	22	24
30	20 <sup>b</sup>	20	22	24
35	20 <sup>b</sup>	22	22	24
40	20 <sup>b</sup>	22	22	24
45	20	22	22	24
50	20	22	22	24
55	22	22	24	24
60	22	22	24	24
All speeds	Width of shoulder on each side of the road (ft)			
	2.0	5.0 <sup>c</sup>	6.0	8.0

<sup>a</sup> On roadways to be reconstructed, a 22-ft traveled way may be retained where the alignment and safety records are satisfactory.

<sup>b</sup> A 18-ft minimum width may be used for roadways with design volumes under 250 veh/day.

<sup>c</sup> Shoulder width may be reduced for design speeds greater than 30 mph as long as a minimum roadway width of 30 ft is maintained.  
 See text for roadside barrier and offtracking considerations.

Where bicycle facilities are included as part of the design, refer to the *AASHTO Guide for the Development of Bicycle Facilities (2)*.

## Parking Lanes

Although on-street parking may constitute a safety problem and may impede traffic flow, provision of parking lanes parallel to the curb is conventional on many collector streets. Parallel parking is normally acceptable on urban collectors where sufficient street width is available to provide a parking lane. In residential areas, a parallel parking lane from 7 to 8 ft in width should be provided on one or both sides of the street, as appropriate for the lot size and density of development. In commercial and industrial areas, parking lane widths should range from 8 to 11 ft and are usually provided on both sides of the street.



The principal problem of diagonal or angle parking, in comparison to parallel parking, is the lack of adequate visibility for the driver during the back-out maneuver. Collector street designs with diagonal or angle parking should only be considered in special cases. ADA guidelines concerning parking should be taken into consideration (7, 8.) For further information, see the section concerning “On-Street Parking” in Chapter 4 (*of the AASHTO Green Book*).

The determination of parking lane width should consider the appropriate width for any likely future use as a lane for moving traffic either continuously or during peak hours. Where curb-and-gutter sections are used, the gutter pan width may be considered as part of the parking lane width, but, where practical, the parking lane widths discussed above should be in addition to the gutter pan width.

## **Medians**

Urban collector streets designed for four or more lanes should include width for an appropriate median treatment, where practical. For general types of median treatments for collector streets, the following widths may be considered: (1) paint-striped separation, 2 to 4 ft wide; (2) narrow raised-curbed sections, 2 to 6 ft wide; (3) raised curbed sections, 10 to 16 ft wide, providing space for left-turn lanes; (4) paint-striped sections, 10 to 16 ft wide, providing space for two-way left-turn lanes; and (5) raised-curb sections, 18 to 25 ft wide to provide more space for left-turn lanes and for passenger cars to stop in median crossovers. Wider medians from 27 to 40 ft may be used for a parkway design where space is available for landscaping. Thus, each increment in additional median width provides specific operational advantages. Median should be as wide as practical within the constraints of each particular site.

On urban collector streets with raised-curb medians, openings should be provided only at intersections with other streets and at reasonably spaced driveways serving major traffic generators such as industrial plants and shopping centers. Where practical, median openings should be designed to include left-turn lanes.

Median openings should be situated only where there is adequate sight distance. The shape and length of the median openings depend on the width of the median and the vehicle types that are to be accommodated. The minimum length of median openings should be that of the projected roadway width of the intersecting cross street or driveway. Desirably, the length of median openings should be great enough to provide a 50 ft turning radius or the turning radius for the design vehicle for left-turning vehicles between the inner edge of the lane adjacent to the median and the centerline of the intersection roadway.

On many urban collectors it may be impractical to use a raised-curb median. A continuous center two-way left-turn lane, flush with the adjacent traveled way, is an alternative design that may also be considered. A further discussion on medians is found in the section on “Medians” in Chapter 4 (*of the AASHTO Green Book*) and the section on “Median Openings” in Chapter 9 (*of the AASHTO Green Book*).

## **Curbs**

Collector streets normally are designed with curbs to allow greater use of available width and for control of drainage, protection of pedestrians, and delineation. The curb on the right side of the traveled way should be a vertical curb, 6 in. high, usually with an appropriate batter (sloping face). On lightly traveled residential streets with grades less than 2 percent, a sloping curb that is lower and does not require modification at driveway entrances may be used. The curb slope should be 1V:6H or flatter.

On divided streets, the type of median curbs should be determined in conjunction with the median width and the type of turning movement control to be provided. Where midblock left-turn movements are permitted and the median width is less than 10 ft, a well-delineated flush or rounded raised median separator 2 to 4 in. high is effective in channelizing traffic and in avoiding excessive travel distances and concentrations of turns at intersections. Where wider traversable medians are appropriate, they may be either flush or bordered with low curbs 1 to 2 in. high. On narrow and intermediate-width medians, and on some wide medians, where cross-median movements are undesirable or create problems, a vertical curb should be used on the median side of the traveled way, usually 6 in. high and with an appropriate batter (sloping face). A median barrier should be used where positive separation of opposing traffic is essential, where there is no need for pedestrian crossings, and where local regulations permit. For further information, see the section on “Curbs” in Chapter 4 (*of the AASHTO Green Book*).

Vertical curbs with heights of 6 in. or more, adjacent to the traveled way, should be offset by 1 to 2 ft from the edge of the traveled way. Where there is combination curb-and-gutter construction, the gutter pan width, which is normally 1 to 2 ft, may provide the offset distance.

## **Drainage**

Surface runoff is gathered by a system of gutters, inlets, catch basins, and storm sewers. The gutter grade should be 0.3 percent or more. However, a gutter grade of 0.5 percent or more should be used, where practical, for better drainage. Inlets or catch basins with an open grate should be

located in the gutter line and should be so spaced that ponding of water on the pavement does not exceed tolerable limits. In addition, grates should be designed to accommodate bicycle and pedestrian traffic. For additional details, see the drainage portions of Chapters 3 and 4 (*of the AASHTO Green Book*).

Drainage will be according to current SDDOT standards as discussed in the SDDOT Road Design Guide. A minimum gutter grade of 0.5% should be used whenever possible.

## **Sidewalks**

Sidewalks should be provided along both sides of urban collector streets that are used for pedestrian access to schools, parks, shopping areas, and transit stops and along all collectors in commercial areas. In residential areas, sidewalks are desirable on both sides of collector streets, but should be provided on at least one side. The sidewalk should be situated as far as practical from the traveled way, usually close to the right-of-way line. For further information, see the section on “Sidewalks” in Chapter 4 (*of the AASHTO Green Book*). Additional design guidance on sidewalks can also be found in the *AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities* (9).

The minimum sidewalk width should be at least 4 ft in residential areas and should range from 4 to 8 ft in commercial areas. Sidewalk widths of at least 5 ft are recommended by the *ADAAG* (7,8).

Sidewalk curb ramps should be provided at crosswalks to accommodate persons with disabilities. The section on “Pedestrian Facilities” in Chapter 4 (*of the AASHTO Green Book*) discusses various design applications at such ramps.

## **Driveways**

Driveways should be regulated as to width of entrance, placement with respect to property lines and intersecting streets, angle of entrance, vertical alignment, and number of entrances to a single property. ADA guidelines should be considered in the design of driveways (6,7). Further guidance on the design of sidewalk-driveway interfaces can be found in the *AASHTO Guide for the Planning, Design, and Operations of Pedestrian Facilities* (9).

## Roadway Widths for Bridges

The clear width for all new bridges on urban collector streets with curbed approaches should be the same as the curb-to-curb width of the approaches. The bridge rail should be placed flush with the front face of the curb if no sidewalk is present to minimize the likelihood that vehicles will vault the rail. For urban collector streets with shoulders and no curbs, the full width of approach roadways should preferably be extended across bridges. Sidewalks on the approaches should be extended across all new structures. In addition, a sidewalk should be included on at least one side on all bridges on collector streets. Further discussion of roadway widths for bridges is presented in the section on “Traffic Barriers” in Chapter 4 (*of the AASHTO Green Book*). Exhibits 6-6 and 6-7 apply to bridge widths on urban collector streets.

### Minimum Roadway Widths and Design Loadings for New and Reconstructed Bridges

Exhibit 6-6, page 426, AASHTO 2004.

Design volume (veh/day)	Minimum clear roadway width for bridges <sup>a</sup>	Design loading structural capacity
400 and under	Traveled way + 2 ft (each side)	HS 20
400 to 1500	Traveled way + 3 ft (each side)	HS 20
1500 to 2000	Traveled way + 4 ft (each side) <sup>b</sup>	HS 20
over 2000	Approach roadway (width) <sup>b</sup>	HS 20

<sup>a</sup> Where the approach roadway width (traveled way plus shoulders) is surfaced, that surface width should be carried across the structures.

<sup>b</sup> For bridges in excess of 100ft in length, the minimum width of traveled way plus 3 ft on each side is acceptable.

**Structural Capacities and Minimum Roadway Widths for  
Bridges to Remain in Place**

**Exhibit 6-7, page 427, AASHTO 2004.**

Design volume (veh/day)	Design loading structural capacity	Minimum clear roadway width (ft) <sup>a</sup>
under 400	H 15	22
400 to 1500	H 15	22
1500 to 2000	H 15	24
over 2000	H 15	28

a Clear width between curbs or railings, whichever is less, should be equal to or greater than the approach traveled way width, wherever practical.

### **Vertical Clearance**

Vertical clearance at underpasses should be at least 14 ft over the entire roadway width, with an additional allowance for future resurfacing.

### **Horizontal Clearance to Obstructions**

Roadside obstructions on urban collector streets should preferably be located at or near the right-of-way line and outside of the sidewalks. On urban collector streets that have curbs but no shoulders, a clearance of 1.5 ft or more beyond the face of the curb should be provided to roadside obstructions, where practical. Where a continuous parking lane is provided, no clearance is needed, but a setback of 1.5 ft to obstructions is desirable to avoid interference with opening car doors. In areas of dense pedestrian traffic, the provision of vertical curbing between the traveled way and adjacent street fixtures will discourage drivers from encroaching on the sidewalk. Urban collector streets with shoulders and without curbs should have clear zones, as described previously for rural collectors.

Roadside obstacles, such as trees, that might seriously damage out-of-control vehicles should be removed wherever practical. However, the potential benefits of removing such obstacles should be weighted against the adverse environmental and aesthetic effects of their removal. Therefore, trees should be removed only when considered essential for safety. However, it may only be practical to remove those fixed objects in very vulnerable locations. For further information, see the section on "Horizontal Clearance to Obstructions" in Chapter 4 (*of the AASHTO Green Book*).

A wide and level border area should be provided along collector streets for the safety of the motorist and pedestrian, as well as for aesthetic reasons. However, the preservation and enhancement of the environment are of

major importance in the design and construction of collector streets and may preclude provision of a border area. The street alignment should be selected to minimize cut and fill slopes.

Roadside barriers are not used extensively on urban collector streets except where there are safety concerns or environmental considerations such as along sections with steep foreslopes and at approaches to structures. Roadside barriers may also be needed to shield vehicles from over-crossing structures.

### **Right-of-Way Width**

The right-of-way width should be sufficient to accommodate the ultimate planned roadway, including median, shoulder, grass border, sidewalks, bicycle facilities, public utilities, and outer slopes. The width of right-of-way for a two-lane urban collector street should generally range from 40 to 60 ft, depending on the conditions listed above.

### **Provision for Utilities**

In addition to the primary purpose of serving vehicular traffic, urban collector streets may accommodate public utility facilities within the street right-of-way in accordance with state law or municipal ordinance. Use of right-of-way by utilities should be planned to minimize interference with traffic using the street. The *AASHTO Guide for Accommodating Utilities within Highway Right-of-Way (10)* presents general principles for utility location and construction to minimize conflicts between the use of the street right-of-way for vehicular movements and the secondary objective of providing space for locating utilities.

### **Border Area**

The border area between the roadway and the right-of-way line should be wide enough to serve several purposes, including the provision of a buffer space between pedestrians, bicyclists, and vehicular traffic; a sidewalk; and an area for underground and above-ground utilities such as traffic signals, parking meters, and fire hydrants. A portion of the border area should accommodate snow storage and may include aesthetic features such as grass or landscaping. The border width should range from 8 to 11 ft, including the sidewalk width. For safety reasons, traffic signals, utility poles, fire hydrants, and other utilities should be placed as far back from the curb as practical. Breakaway features may be built into such obstacles, where practical, as an aid to safety.

## **Intersection Design**

The pattern of traffic movements at intersections and the volume of traffic on each approach during one or more peak periods of the day, including pedestrian and bicycle traffic, are indicative of the appropriate type of traffic control devices, the widths of lanes (including auxiliary lanes), and where applicable, the type and extent of channelization needed to expedite the movement of traffic. The arrangement of islands and the shape and length of auxiliary lanes may differ depending on whether or not signal control is used. The composition and character of traffic is a design control; movements involving large trucks need larger intersection areas and flatter approach grades than those used at intersections where traffic consist predominantly of passenger cars. Bus stops located near an intersection may create a need for additional modifications to the intersection design. Approach speeds of traffic also have a bearing on the geometric design as well as on the appropriate traffic control devices and pavement markings. For further information, see the section on “Traffic Control Devices” in Chapter 3 (*of the AASHTO Green Book*).

The number and location of approach roadways and their angles of intersection are major controls for the intersection geometric design, the location of islands, and the types of control devices. Intersections at grade preferably should be limited to no more than four approach legs. When two crossroads intersect the collector highway in close proximity, they should be combined into a single intersection.

Important design considerations for at-grade intersections fall into two major categories: the geometric design of the intersection (including a capacity analysis) and the location and type of traffic control devices. For the most part, these considerations are applicable to both new and existing intersections although, for existing intersections in built-up areas, heavy development may make extensive design changes impractical.

Chapter 9 (*of the AASHTO Green Book*) presents a discussion of all major aspects of intersection design.

## **Railroad-Highway Grade Crossings**

Appropriate grade crossing warning devices should be installed at all railroad-highway grade crossings on collector streets. Details of these devices are given in the *MUTCD* (6). In some state, the final approval of these devices may be vested in an agency having oversight over railroads.

In South Dakota the final approval of these devices is determined as a joint decision between the agency having jurisdiction over the particular road and the applicable railroad.

Sight distance is an important consideration at railroad-highway grade crossings on collector streets. There should be sufficient sight distance along the street for the approaching driver to recognize the railroad crossing, perceive the warning device, determine whether a train is approaching, and stop if necessary. Adequate sight distance along the tracks is also needed for drivers of stopped vehicles to decide when it is safe to proceed across the tracks.

The roadway width at all crossing should be the same as the curb-to-curb width of the approaches. Where street sections are not curbed, the crossing width should be consistent with the approach street and shoulder widths. Sidewalks should be provided at railroad crossings where approach sidewalks exist or are planned within the near future. Provisions for future sidewalks should be incorporated into design, if they can be anticipated, to avoid future crossing work on the railroad facility.

Crossings that are located on bicycle routes that are not perpendicular to the railroad may need additional paved shoulder width for bicycles to maneuver over the crossing. For further information, see the *AASHTO Guide for the Development of Bicycle Facilities (2)*.

The design of railroad-highway grade crossings is discussed more fully in Chapter 9 (*of the AASHTO Green Book*).

### **Street and Roadway Lighting**

Good visibility under both day and night conditions is fundamental to enabling motorists, pedestrians, and bicyclists to travel on roadways in a safe and coordinated manner. Properly designed and maintained street lighting should provide comfortable and accurate night visibility, which should facilitate vehicular, bicycle, and pedestrian traffic.

Decisions concerning appropriate street lighting should be coordinated with safety management, crime prevention, and other community concerns. The *AASHTO publication An Informational Guide for Roadway Lighting (11)* provides discussion on street and roadway lighting. Further information is also provided in the section on “Lighting” in Chapter 3 (*of the AASHTO Green Book*).



## **Traffic Control Devices**

Traffic control devices should be applied consistently and uniformly. Details of the standard devices and warrants for many conditions are found in the *MUTCD (6)*.

Geometric design of streets should include full consideration of the types of traffic control to be used, especially at intersections where multi-phase or actuated traffic signals are likely to be needed. Signal progression, signal phasing (including pedestrian and bicycle phases), and traffic flow rates are important considerations in major signalized intersection design. For further information, see the section on “Traffic Control Devices” in Chapter 3 (*of the AASHTO Green Book*).

Chapter 31-28-11 of the South Dakota Codified Laws states that on any street or road constructed with federal aid, all traffic control devices shall conform to uniform national signing standards. These standards can be found in the *MUTCD*.

## **Erosion Control**

Design of streets should consider preservation of natural ground cover and desirable growth of shrubs and trees within the right-of-way. Seeding, mulching, sodding, or other acceptable measures for covering slopes, swales, and other erodible areas should also be considered in urban collector street design. For further information, see the section on “Erosion Control and Landscape Development” in Chapter 3 (*of the AASHTO Green Book*).

## **Landscaping**

Landscaping should be provided in keeping with the character of the street and its environment for both aesthetic and erosion control purposes. Landscape designs should be arranged to permit a sufficiently wide, clear, and safe pedestrian walkway. The needs of individuals with disabilities, bicyclists, and pedestrians should be considered. Combinations of turf, shrubs, and trees should be considered in continuous border areas along the roadway. However, care should be exercised to ensure that sight distances and guidelines on clearance to obstructions are observed, especially at intersections. The roadside should be developed to serve both the community and the traveling motorist. Landscaping should also consider maintenance problems and costs, future sidewalks, utilities, additional lanes, and possible bicycle facilities. For further information on landscaping, see the *AASHTO Guide for Transportation Landscape and Environmental Design (12)*.

**ADA Guidelines – See Chapter 16 of the SDDOT Road Design Manual.**

**REFERENCES**

1. Transportation Research Board. *Highway Capacity Manual*, 4th edition, Washington, D.C.: Transportation Research Board, 2000 or most current edition.
2. AASHTO. *Guide for the Development of Bicycle Facilities*, Washington, D.C.: AASHTO, 1999.
6. U.S. Department of Transportation, Federal Highway Administration. *Manual on Uniform Traffic Control Devices for Streets and Highways*, Washington, D.C.: 2003 or most current edition.
7. Architectural and Transportation Barriers Compliance Board (Access Board). *Americans with Disabilities Act Accessibility Guidelines (ADAAG)*, Washington, D.C.: July 1994 or most current edition.
8. UFAS. *Uniform Federal Accessibility Standards*, most current edition.
9. AASHTO. *Guide for the Planning, Design, and Operation of Pedestrian Facilities*, Washington, D.C.: AASHTO, 2004.
10. AASHTO. *Guide for Accommodating Utilities within Highway Right-of-Way*, Washington, D.C.: AASHTO, 1994.
11. AASHTO. *An Informational Guide for Roadway Lighting*, Washington, D.C.: AASHTO, 1985.
12. AASHTO. *A Guide for Transportation Landscape and Environmental Design*, Washington, D.C.: AASHTO, 1991.

## URBAN ARTERIALS

### General Characteristics

Urban arterials carry large traffic volumes within and through urban areas. Their design varies from freeways with fully controlled access to two-lane streets. The type of arterial selected is closely related to the level of service desired. The principal objective for an urban arterial should be mobility with limited or restricted service to local development. If restriction of local access is not practical, special designs that incorporate access management are desirable. Such designs can vary from roadways that provide separate turn lanes to one-way streets.

Urban arterials are capable of providing some access to abutting property. Such access service should, however, be only incidental to the arterial's primary function of serving major traffic movements.

Before designing an urban arterial, it is important to establish the extent and need for such a facility. Once the need is established, steps should then be taken to protect the ability of the arterial to serve traffic at the desired level of service from future changes, such as strip development or the unplanned location of a major traffic generator. Development along an arterial should be anticipated regardless of a city's size. However, with proper planning and design, such development need not seriously affect the arterials' major function of safely serving through travel. Rather, it can complement such development and continue to provide the desired level of service.

Urban arterials are functionally divided into two classes, principal and minor. These classes are discussed in detail in Chapter 1 (*of the AASHTO Green Book*). The urban arterial system, which includes arterial streets and freeways, serves the major activity centers of a metropolitan area, the highest traffic volume corridors, and the longest trips. The portion of the arterial system, either planned or existing, on which access is not fully controlled constitutes the arterial street system for the urban area. From the standpoint of design characteristics, all such urban streets are treated as a single class and are addressed in this chapter. Design of freeways is addressed in Chapter 8 (*of the AASHTO Green Book*).

### General Design Considerations

In the development of a transportation improvement program, routes selected for improvement as arterials may comprise portions of an existing street system, or they may be projected locations on new alignments through relatively undeveloped areas. Usually, they will be existing streets because, historically, the need for improving existing streets has

surpassed the availability of resources. As a consequence, street improvements tend to lag, rather than lead, land-use development.

Major improvement of existing arterials can be extremely costly, particularly where additional rights-of-way need to be acquired through highly developed areas. Accordingly, it is often necessary to use design values that are less than desirable and below the design values that are used where sufficient right-of-way is available or can be acquired economically. When restricted conditions are encountered, consideration should be given to providing above-desirable values for other design or traffic control elements that tend to offset those created by the restriction (e.g., eliminating left-turn movements through an area having less-than-normal lane widths).

### **Design Speed**

Design speeds for urban arterials generally range from 30 to 60 mph. Lower speeds apply in central business districts and in more developed areas, while higher speeds are more applicable to outlying suburban and developing areas. Design speed should be selected as described in Chapter 2 (*of the AASHTO Green Book*).

### **Design Traffic Volume**

The design of urban arterials should be based on traffic data developed for the design year, normally 20 years from the date of construction completion. The DHV is the most reliable traffic volume measure representing the traffic demand for use in design of urban arterials. Sometimes, capacity analysis, which is used to determine whether a particular design can provide a desired level of service for those conditions represented by the design traffic volume, is also used as a design tool. Refer to Chapter 2 (*of the AASHTO Green Book*) for further information on design traffic volumes and capacity analysis.

### **Levels of Service**

For acceptable degrees of congestion, rural and suburban arterials and their auxiliary facilities (i.e., turning lanes, weaving sections, intersections, interchanges, and traffic control systems [traffic signals], etc.), should generally be designed for level-of-service C. In heavily developed sections of metropolitan areas, the use of level-of-service D may be appropriate. When level-of-service D is selected, it may be desirable to consider the use of one-way streets or alternative bypass routes to improve the level of service. For additional guidance on determining the level of service for a specific facility, refer to the *Highway Capacity Manual* (2).

## Sight Distance

The provision of adequate sight distance is important in urban arterial design. Sight distance affects normal operational characteristics, particularly where roadways carry high traffic volumes. The sight distance values given in Exhibit 7-1 are also applicable to urban arterial design. Design values for intersection sight distance are presented in Chapter 9 (*of the AASHTO Green Book*).

**Minimum Sight Distances for Arterials**  
**Exhibit 7-1, page 445, AASHTO 2004.**

Design speed (mph)	Minimum stopping sight distance (ft)	Minimum passing sight distance (ft)
30	200	1090
35	250	1280
40	305	1470
45	360	1625
50	425	1835
55	495	1985
60	570	2135
65	645	2285
70	730	2480
75	820	2580
80	910	2680

## Alignment

The alignment of an urban arterial should be developed in strict accordance with its design speed, particularly where a principal arterial is to be constructed on a new location and is not restricted by normal right-of-way constraints. There are many situations, however, where this is not practical. An example of this is the necessity to shift (deflect) the alignment of through lanes to accommodate the inclusion of left-turn lanes in an intersection area. Under such circumstances, the intersection alignment should be consistent with the guidance in Chapter 9 (*of the AASHTO Green Book*). It is desirable to use the best alignment design practical since curves on urban arterials are often not superelevated in the low-speed range. (See discussion in this chapter in the section below on "Superelevation" for further explanation.)

## Grades

The grades selected for an urban arterial may have a significant effect on its operational performance. For example, steep grades affect truck speeds and the overall capacity on the facility. On arterials having large numbers of trucks and operating near capacity, flat grades should be

considered to avoid undesirable speed reductions. Steep grades may also result in operational problems at intersections, particularly during adverse weather conditions. For these reasons, it is desirable to provide the flattest grades practical while providing at least minimum gradients to ensure adequate longitudinal drainage in curbed sections. The recommended maximum grades for urban arterials are presented in Exhibit 7-10. Where steep grades cannot be flattened, climbing lanes should be considered, based on the warrants presented in Chapter 3 (*of the AASHTO Green Book*).

**Maximum Grades for Urban Arterials**  
**Exhibit 7-10, page 472, AASHTO 2004.**

Type of terrain	Maximum grade (%) for specified design speed (mph)						
	30	35	40	45	50	55	60
Level	8	7	7	6	6	5	5
Rolling	9	8	8	7	7	6	6
Mountainous	11	10	10	9	9	8	8

## Superelevation

Curves on low-speed, curbed arterial streets are often not superelevated. Difficulties associated with drainage, ice formation, driveways, pedestrian crossings, and the effect on adjacent developed property should be evaluated when superelevation is considered. The section on “Horizontal Alignment” in Chapter 3 (*of the AASHTO Green Book*) provides a more detailed discussion of superelevation. When little or no superelevation is to be provided on curves for low-speed arterial streets, the Case II distribution of superelevation discussed in Chapter 3 (*of the AASHTO Green Book*) usually is used. Supplemental guidance applicable to both rural and urban arterials is presented in the section on “Superelevated Cross Sections” in the earlier discussion of rural arterials in this chapter.

## Cross Slope

Sufficient cross slope for adequate pavement drainage is important on urban arterials. The typical problems related to splashing and hydroplaning are compounded by heavy traffic volumes and curbed sections, especially for high speeds. Cross slopes should range from 1.5 to 3 percent; the lower portion of this range is appropriate where drainage flow is across a single lane and higher values are appropriate where flow is across several lanes. Even higher cross-slope rates may be used for parking lanes. The overall cross section should provide a smooth appearance without sharp breaks. Because urban arterials are often curbed, it is necessary to provide for longitudinal as well as cross-slope

drainage. The use of higher cross-slope rates also reduces flow on the roadway and ponding of water due to pavement irregularities and rutting. The section on “Cross Slopes” in Chapter 4 (*of the AASHTO Green Book*) provides additional guidance.

### **Vertical Clearances**

New or reconstructed structures should provide 16 ft vertical clearance over the entire roadway width. Existing structures that provide clearance of 14 ft, if allowed by local statute, may be retained. In highly urbanized areas, a minimum clearance of 14 ft may be provided if there is an alternate route with 16 ft clearance. Structures should provide additional clearance for future resurfacing of the underpassing road.

### **Lane Widths**

Lane widths may vary from 10 to 12 ft. Lane widths of 10 ft may be used in highly restricted areas having little or no truck traffic. Lane widths of 11 ft are used quite extensively for urban arterial street designs. The 12 ft lane widths are most desirable and should be used, where practical, on higher speed, free-flowing, principal arterials.

Under interrupted-flow operating conditions at low speeds (45 mph or less), narrower lane widths are normally adequate and have some advantages. For example, reduced lane widths allow more lanes to be provided in areas with restricted right-of-way and allow shorter pedestrian crossing times because of reduced crossing distances. Arterials with reduced lane widths are also more economical to construct. An 11 ft lane width is adequate for through lanes, continuous two-way left-turn lanes, and lanes adjacent to a painted median. Left-turn and combination lanes used for parking during off-peak hours and for traffic during peak hours may be 10 ft in width. If provision for bicyclists is to be made, see the *AASHTO Guide for the Development of Bicycle Facilities* (6).

If substantial truck traffic is anticipated, additional lane width may be desirable. The widths needed for all lanes and intersection design controls should be evaluated collectively. For instance, a wider right-hand lane that provides for right turns without encroachment on adjacent lanes may be attained by providing a narrower left-turn lane. Local practice and experience regarding lane widths should also be evaluated.

### **Curbs and Shoulders**

Shoulders are desirable on any highway, and urban arterials are no exception. Where four lanes are warranted, shoulders are desirable. They contribute to enhanced safety by affording maneuver room and

providing space for immobilized vehicles. They offer a measure of safety to the occasional pedestrian in sparsely developed areas where sidewalks are not appropriate and provide space for bicyclists where allowed by law. They also serve as speed-change lanes for vehicles turning into driveways and provide storage space for plowed snow.

Despite the many advantages of shoulders on arterial streets, their use is generally limited due to restricted right-of-way and the necessity of using the available right-of-way for traffic lanes. Where the abutting property is used for commercial purposes or consists of high-density residential development, a shoulder, if provided, is subject to such heavy use in serving local traffic that the pavement strength of the shoulder must be about the same as that for the travel lanes. In urban and suburban areas, the outside edges of shoulders are often curbed and a closed drainage system provided to minimize the amount of right-of-way needed. In addition, curbs are often appropriate in heavily developed areas as a means of controlling access.

In those instances where sufficient right-of-way exists to consider shoulders, refer to the discussion on shoulders in the rural arterial section of this chapter for guidance. Where provision of shoulders is not practical, and curbs are to be used, refer to the section on “Curb Placement” in Chapter 4 (*of the AASHTO Green Book*).

### **Number of Lanes**

The number of lanes varies, depending on traffic demand and availability of the right-of-way, but the normal range for urban arterial streets is four to eight lanes in both directions of travel combined. A capacity analysis should be performed to determine the proper number of lanes. In addition, roadways are sometimes widened through intersections by the addition of one or two lanes to accommodate turning vehicles. Chapter 2 (*of the AASHTO Green Book*) presents additional information on capacity analysis.

### **Width of Roadway**

The roadway width should be adequate to accommodate through and turning traffic lanes, medians, curbs, and appropriate clearances from curb or barrier faces. Parking on arterial streets should only be considered when needed because of existing conditions. When parking lanes are provided, consideration should be given to providing a width adequate to allow ultimate operation as a traffic lane. In many instances at intersections, the parking lane is used to provide a right-turn lane or used as a through lane in order to provide additional width for a left-turn lane.



## **Drainage**

An adequate drainage system to accommodate design runoff should be included in the design of every arterial street. Inlets that are safe for bicycles should be located adjacent to and upstream of intersections and at intermediate locations where necessary. Where a shoulder or parking lane is provided, the full width of the shoulder or parking lane may be utilized to conduct surface water to the drainage inlets. Where no shoulder or parking lane is provided, one-half of the outside traffic lane and curb offset may be utilized to conduct surface drainage, provided two or more traffic lanes exist in each direction. Ponding of water at low points in the traveled way on arterial streets is undesirable. The width of water spread on the roadway should not be substantially greater than the width of the spread encountered on continuous grades. Highways with design speeds greater than 45 mph will have a higher potential for hydroplaning if the traveled way is covered with water. Additional inlets should be provided in sag locations to avoid ponding of water where the grade flattens to zero percent and to mitigate flooding should an inlet become clogged. Chapters 3 and 4 (*of the AASHTO Green Book*) have comprehensive discussions concerning drainage.

Drainage will be according to current SDDOT standards as discussed in the SDDOT Road Design Guide.

## **Parking Lanes**

Where parking is needed and adequate off-street parking facilities are not available or practical, parallel parking may be considered as long as adequate capacity is provided by the through lanes. However, parking is highly undesirable on high-speed roadways.

Passenger vehicles parked adjacent to a curb will occupy, on the average, approximately 7 ft of street width. Therefore, the total parking lane width for passenger cars should be 10 to 12 ft. This width is also adequate for an occasional parked commercial vehicle. For desirable widths to accommodate usage by bicyclist, refer to the *AASHTO Guide for the Development of Bicycle Facilities* (6). Where it is unlikely that there will be a future need to use the parking lane as a through lane, a parking lane width as narrow as 8 ft may be acceptable.

A parking lane less than 11 ft in width is considered undesirable if future use of the parking lane for through traffic is anticipated. Such a lane can be used as an additional through-traffic lane during peak hours by prohibiting parking during these hours. A parking lane 10 ft in width is acceptable for use as a storage lane for turning vehicles at signalized

intersections by prohibiting parking for some distance upstream from the intersection. A parking lane of 9 ft may be acceptable as a storage lane for turning vehicles where the design speed on the arterial is 40 mph or less.

The marking of parking spaces on arterial streets encourages more orderly and efficient use where parking turnover is substantial and also tends to prevent encroachment on fire hydrant zones, bus stops, loading zones, approaches to corners, clearance space for islands, and other zones where parking is prohibited. Typical parking-space markings are shown in the *MUTCD (1)*.

In downtown districts and in areas with large office or industrial buildings, it may be possible to provide parking turnouts.

See Exhibit 7-12, page 479 of the AASHTO Green Book, for an illustration showing a 24 ft paved turnout, and a curbed island separating the turnout from the through lanes.

### **Borders and Sidewalks**

The border is the area between the roadway and the right-of-way line that separates traffic from adjacent homes and businesses. For a minimum section in a residential area, the border area should include a sidewalk and a buffer strip between the sidewalk and curb.

See Exhibit 7-13, page 480 of the AASHTO Green Book, for an illustration of an arterial street in a residential area. The exhibit shows curbs, a parking lane, curb cuts for driveways, and sidewalks. In blocks that are fully developed with retail stores and offices, the entire border area usually is devoted to sidewalk.

Some factors to be considered in determining border widths are width of sidewalk for pedestrian needs, snow storage, storm drainage, traffic control devices, roadside appurtenances, and utilities. The minimum border should be 8 ft wide and preferably 12 ft or more. Every effort should be made to provide wide borders not only to serve functional needs but also as a matter of aesthetics, safety, and reducing the nuisance of

traffic to adjacent development. Where sidewalks are not included as a part of the initial construction, the border should be sufficiently wide to provide for their future installation. For further information, see the section on “Pedestrian Facilities” presented later in this chapter.

Where bicycle traffic is anticipated or is to be served on arterial streets, provisions to accommodate bicycles should be in accordance with the *AASHTO Guide for the Development of Bicycle Facilities* (6).

See Exhibit 7-14, page 481 of the AASHTO Green Book for an illustration of a divided arterial street in a residential area. This type of arterial features a turf buffer/border strip that is provided between the sidewalk and the curb. In addition, vertical curb-and-gutter sections are employed on the outside of parking lanes that may also serve as shoulders.

### **Railroad-Highway Crossings**

Railroad-highway crossings on an urban arterial can often be the most disruptive feature affecting its operation. Crossings that are frequently occupied or occupied during high-volume traffic periods should be treated by providing a grade separation. Crossings that are occupied only infrequently or during off-peak traffic periods may be operated as an at-grade crossing with high-type traffic control, such as gate-equipped automatic flashing signals.

At-grade crossings that involve bicycle routes that are not perpendicular to the railroad may need additional paved shoulder width to allow bicyclists to maneuver over the crossing. For further information, see the *AASHTO Guide for the Development of Bicycle Facilities* (6).

### **Roadway Width for Bridges**

The minimum clear width for new bridges on arterial streets should be the same as the curb-to-curb width of the street. On long bridges, defined as bridges with overall lengths in excess of 200 ft, the offsets to parapets, rails, or barriers may be reduced to 4 ft where shoulders or parking lanes are provided on the arterial. For further relevant discussion, see the sections on “Curbs,” “Sidewalks,” “Traffic Barriers,” and “Bridge Railings” in Chapter 4 (*of the AASHTO Green Book*).

## **Bridges to Remain in Place**

Reasonable attempts should be made to improve existing structures that do not meet current design policies or guidelines, but are otherwise suitable for retention. When making this decision, an important consideration is the extent to which such features that do not meet current policies and guidelines are likely to contribute to crash frequency and operational deficiencies. Other factors to be considered include the remaining life, the cost of improvements and/or rehabilitation compared to replacement, and the historical significance, aesthetic value, and notoriety of the structure.

## **Horizontal Clearance to Obstructions**

Clear roadside design is recommended for urban arterials whenever practical. On curbed street sections, clear roadsides are often impractical, particularly in restricted areas. In such areas, a clearance between curb face and object of 1.5 ft (or wider where practical) should be provided. A 3 ft clearance to roadside objects should be provided particularly near turning radii at intersections and driveways. This offset provides sufficient clearance to keep the overhang of a truck from striking an object. Where pedestrians are not a factor, obstructions should be set well back, protected, or provided with breakaway features. For further guidance, refer to *AASHTO Roadside Design Guide (3)*.

## **Right-of-Way Width**

The width of right-of-way for the complete development of an arterial street is influenced by traffic demands, topography, land use, cost, intersection design, and the extent of ultimate expansion. The width of right-of-way should be the summation of the various cross-sectional elements: through traveled ways, medians, auxiliary lanes, shoulders, borders, and , where appropriate, frontage roads, roadside clear zones, sideslopes, drainage facilities, utility appurtenances, and retaining walls. The width of right-of-way should be based on the preferable dimensions of each element to the extent practical in developed areas. The designer is confronted with the problem of providing an overall cross section that will give maximum service within a limited width of right-of-way. Right-of-way widths in urban areas are governed primarily by economic considerations, physical obstructions, or environmental concerns. Along any arterial route, conditions of development and terrain vary, and accordingly, the availability of right-of-way varies. For this reason, the right-of-way on a given facility should not be a fixed width predetermined on the basis of the most critical point along the facility. Instead, every opportunity should be taken to provide a desirable right-of-way width along most, if not all, of the facility.

## **Traffic Barriers**

Traffic barriers are sometimes used on urban arterials in restricted areas, at separations, and in medians. The barrier should be compatible with the desired visual quality and should be installed in accordance with accepted practice. Exposed ends should be treated with crashworthy designs or other appropriate means. For further information, refer to the *AASHTO Roadside Design Guide (3)*.

## **References for Additional Items**

Refer to the AASHTO Green Book, as noted, for detailed discussions on the following additional items:

Medians – page 474  
Access Management – page 482  
Pedestrian Facilities – page 484  
Provision for Utilities – page 486  
Intersection Design – page 486  
Operational Control and Regulations – page 486  
Frontage Roads and Outer Separations – page 494  
Grade Separations and Interchanges – page 494  
Erosion Control – page 496  
Lighting – page 496  
Bikeways – page 496  
Public Transit Facilities – page 496

**ADA Guidelines – See Chapter 16 of the SDDOT Road Design Manual.**

## **REFERENCES**

1. U.S. Department of Transportation, Federal Highway Administration. *Manual on Uniform Traffic Control Devices for Streets and Highways*, Washington, D.C.: 2003 or most current edition.
2. Transportation Research Board. *Highway Capacity Manual*, 4th edition, Washington, D.C.: Transportation Research Board, 2000 or most current edition.
3. AASHTO. *Roadside Design Guide*, Washington, D.C.: AASHTO, 2002.
6. AASHTO. *Guide for the Development of Bicycle Facilities*, Washington, D.C.: AASHTO, 1999.



## **APPENDIX 1**

### **VERY LOW-VOLUME LOCAL ROADS (ADT $\leq$ 400)**

NOTE: Appendix 1 contains information reproduced from Chapter 4, Design Guidelines, of the 2001 edition of the AASHTO publication, "Guidelines for Geometric Design of Very Low-Volume Local Roads (ADT  $\leq$  400)". To maintain uniformity, exhibit and reference numbers have not been changed from those shown in this publication. All exhibits in Appendix 1 are in English units and any chapters referenced are as found in this publication.

### **CROSS SECTION**

The key elements of cross section design for a roadway are traveled way width and shoulder width. Cross section design criteria for lower volume roads generally address total roadway width (traveled way plus shoulders) rather than having separate criteria for lane and shoulder width. Many lower volume roadways have no painted edgelines and do not have paved shoulders or a material that contrasts with the traveled-way pavement, so there may be no clear demarcation between the traveled way and shoulders. Design guidelines for cross section in new construction projects and on existing very low-volume local roads are presented below.

#### **New Construction**

The design guidelines for cross section in new construction projects on very low-volume local roads differ between rural and urban areas. Each set of design guidelines is presented below. While the quantitative design guidelines for new construction address only total roadway widths, designers should also give consideration to the appropriate right-of-way width. In new construction projects, ample right-of-way should be obtained, whenever practical, to accommodate possible future widening of the roadway.

#### **Very Low-Volume Local Roads in Rural Areas**

Exhibit 1 presents the guidelines for total roadway widths for newly constructed roads in rural areas. The total roadway width criteria vary from 18 to 26 ft with the functional subclass and the design speed of the road. These values were developed in research by Neuman (3) from several sources. The primary source for cross section widths was NCHRP Report 362 (5); other sources included TRB Special Report 214 (4), the United States Forest Service (USFS) (11), and the Transportation Association of Canada (12).

**Guidelines for Total Roadway Width for New Construction of Very Low-Volume Local Roads in Rural Areas**

**Exhibit 1., page 18, AASHTO ADT<400 2001**

<b>US Customary</b>						
Total roadway width (ft) by functional subclass						
Design speed (mph)	Major access	Minor access	Recreational and scenic	Industrial/commercial access	Resource recovery	Agricultural access
15	-	18.0	18.0	20.0	20.0	22.0
20	-	18.0	18.0	20.0	20.0	24.0
25	18.0	18.0	18.0	21.0	21.0	24.0
30	18.0	18.0	18.0	22.5	22.5	24.0
35	18.0	18.0	18.0	22.5	22.5	24.0
40	18.0	18.0	20.0	22.5	-	24.0
45	20.0	20.0	20.0	23.0	-	26.0
50	20.0	20.0	20.0	24.5	-	-
55	22.0	-	22.0	-	-	-
60	22.0	-	-	-	-	-

Note: Total roadway width includes the width of both traveled way and shoulders.

**NOTE:** In South Dakota, highway grades shall not be less than twenty feet in width according to state statute.

The cross section width guidelines for major access roads, minor access roads, and recreation and scenic roads are based primarily on travel by passenger cars and recreational vehicles. Widths for industrial/commercial access roads, resource recovery roads, and agricultural roads consider more frequent use by larger trucks and, in the case of agricultural access roads, use by wide agricultural equipment. These greater widths for industrial/commercial access roads, resource recovery roads, and agricultural access roads reflect the offtracking and maneuverability requirements and the greater widths of the larger vehicles using these roads. The ability of vehicles in opposing directions of travel to pass one another is an important design consideration for rural roads. Access past parked vehicles is not a major concern because parking on rural roads is not common. The increased cross section widths for industrial/commercial access roads, resource recovery roads, and agricultural access roads should not be construed as a safety requirement. It should be noted that the roadway widths for agricultural access roads are applicable on roads used by agricultural equipment wider than a typical 8.5 ft truck.

The choice of the appropriate functional subclass is key to determining the appropriate roadway width. Where minimum roadway widths are used for a selected functional subclass, the designer should consider providing a wider roadway at sharp horizontal curves. By contrast, widths less than the minimums shown in Exhibit 1 may be appropriate adjacent to historic structures or in



mountainous terrain. In determining appropriate roadway widths, the designer should refer to the discussion of design flexibility in Chapter 3.

Designers should be afforded great discretion in the use of Exhibit 1, even for new construction. Small differences in the existing or proposed dimensions from those shown in Exhibit 1 may be completely acceptable. For example, on roads used by trucks or wider agricultural equipment, designers should have the discretion to consider the actual widths of vehicles expected to use a particular road and modify the width guidelines in Exhibit 1 accordingly.

### **Very Low-Volume Local Roads in Urban Areas**

As in rural areas, the cross section width guidelines for very low-volume local roads in urban areas are related to basic operational requirements. Speeds are lower, trip lengths and lengths of local roads are generally much shorter, and available right-of-way width is much less than in rural areas. The major functional requirements for very low-volume local roads in urban areas include the ability for vehicles in opposite directions to pass one another, the need for vehicles to pass parked or stopped vehicles, the need to provide access for fire trucks and other emergency vehicles, and the need to accommodate occasional larger delivery vehicles.

Cross section widths for urban major access roads and urban industrial/commercial access roads should generally be the same as those shown for comparable rural roads in Exhibit 1. Greater widths are desirable where parking is permitted.

Cross section width guidelines for urban residential streets are shown in Exhibit 2. These widths incorporate consideration of access for fire trucks and other emergency vehicles and apply to streets where parking is permitted on both sides of the roadway. Reduced widths may be appropriate where parking is restricted. These guidelines are based on the ITE Recommended Guidelines for Subdivision Streets (13).

#### **Guidelines for Total Roadway Width for New Construction of Urban Residential Streets** **Exhibit 2., page 20, AASHTO ADT<400 2001**

Development density	US Customary Total roadway width (ft)
Low	20 to 28
Medium	28 to 34
Note: Low development density represents 2.0 or fewer dwelling units per acre; medium development density represents 2.1 to 6.0 dwelling units per acre.	

The lower end of the range of residential street widths in the ITE guidelines presented in Exhibit 2 are applicable to subdivision streets with sufficient off-

street parking (e.g., driveways and garages) so that on-street parking is used only occasionally by visitors and delivery vehicles. The higher end of the range of street widths is applicable where there is frequent parking on one side of the street. On streets with frequent parking on both sides of the street, street widths greater than those shown in Exhibit 2 may be appropriate.

Design criteria for curbs and sidewalks on very low-volume urban roads and streets should be determined based on local policies and published guidelines for compliance with the Americans with Disabilities Act (ADA).

### **Existing Roads**

The cross section widths of existing roads need not be modified except in those cases where there is evidence of a site-specific safety problem. Chapter 3 discusses the types of evidence of a site-specific safety problem that might be considered. When a site-specific safety problem that can be mitigated by a wider roadway is identified, the cross section for the portion of the roadway with the identified safety problem should be widened to at least the total roadway widths presented above for new construction.

### **BRIDGE WIDTH**

The key elements in selecting an appropriate bridge width are the width of the adjacent roadway (traveled way and shoulder widths) and, for existing locations, the safety performance of the existing bridge. Determination of bridge widths for newly constructed bridges and existing bridges is addressed below.

### **New Construction**

Newly constructed bridges are bridges on new roadways where there is no existing roadway or bridge in place. The widths of newly constructed bridges should generally be selected in accordance with the bridge width criteria for local roads in Chapter 5 of the AASHTO Policy on Geometric Design of Highways and Streets (1). Those criteria state that, for bridges on local roads with ADT of 400 veh/day or less, the bridge width should be equal to the width of the traveled way plus 2 ft. However, when the entire roadway width (traveled way plus shoulders) is paved, the bridge width should be equal to the total roadway width. Bridge width should be measured between the inside faces of the bridge rail or guardrail. Bridges greater than 100 ft in length should be evaluated individually to determine the appropriate bridge width. Bridge usage by trucks and recreational vehicles should also be considered in determining the appropriate width.

One-lane bridges may be provided on single-lane roads and on two-lane roads with ADT less than 100 veh/day where the designer finds that a one-lane bridge can operate effectively. The minimum width of a one-lane bridge should be 15 ft

unless the designer concludes that a narrower bridge can function effectively (e.g., based on the safety performance of similar bridges maintained by the same agency). Caution should be exercised in design of one-lane bridges wider than 16 ft to assure that drivers will not use them as two-lane structures.

Simultaneous arrival of two or more opposing vehicles at a one-lane bridge should be rare, given the low traffic volumes, but one-lane bridges should have intervisible pull-offs at each end where drivers can wait for traffic on the bridge to clear.

### Existing Bridge

Existing bridges can remain in place without widening unless there is evidence of a site-specific safety problem related to the width of the bridge. As described in Chapter 3, evidence of a site-specific safety problem may include not only crash history but also other indications such as skid marks, damage to bridge rail or guardrail, and concerns raised by police or local residents. Where an existing bridge needs replacement for structural reasons, but there is no evidence of a site-specific safety problem, the replacement bridge can be constructed with the same width as the existing bridge; this criterion applies to bridges that are reconstructed on the same alignment and bridges that are reconstructed on a more favorable alignment.

### HORIZONTAL ALIGNMENT

For balance in roadway design, all geometric elements should, as far as economically practical, be designed to provide safe, continuous operation at a speed likely to be observed under the general conditions for that roadway. For the most part, this is done through the use of design speed as the overall control. In the design of roadway curves, it is necessary to establish proper relation between design speed and curvature and also their joint relations with superelevation and side friction. Although these relations stem from the laws of physics, the actual values for use in design depend on practical limits and factors determined more or less empirically over the range of variables involved.

A key parameter that represents the friction demand for a vehicle traversing a horizontal curve is the side friction factor, which can be estimated as:

US Customary	
$f = \frac{V^2}{15R} - 0.01e \quad (1)$	
where:	<p>f = side friction factor</p> <p>V = vehicle speed (mph)</p> <p>R = radius of curve (ft)</p> <p>e = rate of roadway superelevation (percent)</p>

A fundamental objective in horizontal curve design is to select a radius of curve,  $R$ , such that the side friction factor,  $f$ , of a vehicle traversing the curve at the design speed does not exceed a specified threshold value. To achieve this, Equation (1) can be recast as:

<b>US Customary</b>	
$R_{\min} = \frac{V^2}{15(0.01e_{\max} + f_{\max})}$	<b>(2)</b>
<p>where:</p> <div style="margin-left: 150px;"> <math>R_{\min}</math> = minimum curve radius (ft)  <math>e_{\max}</math> = maximum rate of superelevation permitted by highway agency policy  <math>f_{\max}</math> = maximum side friction factor </div>	

The values of  $f_{\max}$  and  $R_{\min}$  used in design of most higher volume roads are specified in Chapter 3 of the AASHTO Policy on Geometric Design of Highways and Streets (1) and are presented here in Exhibit 3. Maximum superelevation rates from 4 to 12 percent may be used in the design of such curves. Guidance in selection of an appropriate maximum superelevation rate is provided by the AASHTO Policy on Geometric Design of Highways and Streets (1). The values of  $f_{\max}$  in Exhibit 3 are intended to assure the comfort of drivers in traversing a curve. Actual tire/pavement friction data indicate that these criteria provide a substantial margin of safety against loss of control due to skidding on most pavements, even at high speeds.

**Maximum Side Friction Factor and Minimum Radius for Horizontal Curve Design on Higher Volume Roadways (1)**  
**Exhibit 3., page 23, AASHTO ADT<400 2001**

US Customary						
Design speed (mph)	Maximum design side friction factor, $f_{max}$	Minimum radius (ft), $R_{min}$				
		Max. superelevation rate (%), $e_{max}$				
		4	6	8	10	12
15	0.175	70	65	60	55	50
20	0.170	125	115	105	100	90
25	0.165	205	185	170	160	145
30	0.160	300	275	250	230	215
35	0.155	420	380	350	320	300
40	0.150	565	510	465	430	395
45	0.145	730	660	600	555	510
50	0.140	930	835	760	695	645
55	0.130	1190	1065	965	880	810
60	0.120	1505	1340	1205	1095	1005

NOTE: Superelevation rates will be according to current SDDOT standards. As stated in the SDDOT Road Design Guide, because of South Dakota's weather conditions, the maximum permissible rate of superelevation is 6%. This will apply to all paved surface roads. The maximum permissible rate of superelevation on gravel surface roads will be 8%. If other conditions arise that warrant consideration of greater rates, these will be discussed on an individual basis.

Exhibit 4 presents the values of  $f_{max}$  and  $R_{min}$  used in design of higher volume low-speed urban streets, as specified in Chapter 3 of the AASHTO Policy on Geometric Design of Highways and Streets (1). These criteria are applicable to urban streets with design speeds of 45 mph or less. Superelevation rates greater than 6 percent are not recommended for such streets because higher rates would be inappropriate for low-speed operation.

**Maximum Side Friction Factor and Minimum Radius for Horizontal Curves on Higher Volume Low-Speed Urban Streets (1)**  
**Exhibit 4., page 24, AASHTO ADT<400 2001**

<b>US Customary</b>				
Design speed (mph)	Maximum design side friction factor, $f_{max}$	Minimum radius (ft), $R_{min}$		
		Max. superelevation rate (%), $e_{max}$		
		4	6	
15	0.330	40	40	
20	0.300	80	75	
25	0.252	145	135	
30	0.221	230	215	
35	0.197	345	320	
40	0.178	490	450	
45	0.163	665	605	

A risk assessment by Neuman (3) found that because established horizontal curve design criteria are based on driver comfort levels, rather than loss of control, the criteria for  $f_{max}$  and  $R_{min}$  can be relaxed for very low-volume local roads with no discernable degradation in safety. The specific criteria applicable to horizontal curve design for new construction projects and for existing very low-volume local roads are presented below.

### **New Construction**

The following guidelines are recommended for design of horizontal curves in new construction of very low-volume local roads:

For design of very low-volume local roads without substantial truck recreational and vehicle volumes, acceptable operations can be obtained with smaller curve radii than those shown in Exhibit 3. Design radii based on a reduction in design speed of 5 to 10 mph may be used. The maximum reduction in design speed of 10 mph is generally appropriate for roadways with speeds of 45 mph or more and with average daily traffic volumes of 250 vehicles per day or less. For roadways with average daily traffic volumes of 250 to 400 vehicles per day without substantial truck volumes, the appropriate maximum reduction in design speed is 10 mph.

For the design of very low-volume local roads carrying substantial recreational vehicle and truck traffic, design radii based on no reduction in design speed should be used at very low speeds (15 mph). This guideline reflects the greater likelihood of truck rollover at low speeds. At higher speeds, design radii based on a reduction in speed of no more than 5 mph may be used.

The specific guidelines for the design of horizontal curves are presented separately for six categories of very low-volume local roads. These are:

rural major access, minor access, and recreational and scenic roads with average daily traffic volumes of 250 vehicles per day or less

rural major access, minor access, and recreational and scenic roads with average daily traffic volumes from 250 to 400 vehicles per day or less

rural industrial/commercial access, agricultural access, and resource recovery roads

urban major access streets with average daily traffic volumes of 250 vehicles per day or less and urban residential streets

urban major access streets with average daily traffic volumes from 250 to 400 vehicles per day

urban industrial/commercial access streets.

Horizontal curve design criteria for new construction of roads in each of these six categories are presented below.

### **Rural Major Access, Minor Access, and Recreational and Scenic Roads (250 Vehicles per Day or Less)**

The design of horizontal curves for major access, minor access, and recreational and scenic roads in rural areas is based on the expectation that the proportion of large trucks on local roads in these functional subclasses is relatively low. Newly constructed rural roads in these subclasses should be designed using the limiting values of  $f_{\max}$  and  $R_{\min}$  shown in Exhibit 3, whenever practical. In constrained situations, for roads with average daily traffic volumes of 250 vehicles per day or less, horizontal curves may be designed using the limiting values for  $f_{\max}$  and  $R_{\min}$  presented in Exhibit 5. This exhibit incorporates reductions in design speed up to 10 mph based on the design principles presented above. Exhibit 5 is appropriate in constrained situations, where providing a horizontal curve designed in accordance with Exhibit 3 would require significant additional costs for earthwork or right-of-way acquisition or would have significantly greater environmental impacts. Design superelevation and superelevation transitions for this category of very low-volume local roads is discussed later in this chapter.

**Guidelines for Maximum Side Friction Factor and Minimum Radius (New Construction, ADT<250 veh/day, Limited Heavy Vehicle Traffic)**  
**Exhibit 5., page 26, AASHTO ADT<400 2001**

US Customary							
Design speed (mph)	Reduced design speed (mph)	Maximum design side friction factor, $f_{max}$	Minimum radius (ft), $R_{min}$				
			Max. superelevation rate (%), $e_{max}$				
			4	6	8	10	12
15	15	0.175	70	65	60	55	50
20	15	0.175	70	65	60	55	50
25	20	0.170	125	115	105	100	90
30	20	0.170	125	115	105	100	90
35	25	0.165	205	185	170	155	145
40	30	0.160	300	275	250	230	215
45	35	0.155	420	380	350	320	295
50	40	0.150	560	510	465	425	395
55	45	0.140	750	675	615	565	515
60	50	0.140	925	835	760	695	640

**Rural Major Access, Minor Access, and Recreational and Scenic Roads (250 to 400 Vehicles per Day)**

As in the previous category, rural major access, minor access, and recreational and scenic roads with average daily traffic volumes from 250 to 400 vehicles per day should be designed with horizontal curves based on the limiting values of  $f_{max}$  and  $R_{min}$  shown in Exhibit 3, whenever practical. In constrained situations, the limiting values of  $f_{max}$  and  $R_{min}$  shown in Exhibit 6 may be used. Exhibit 6 incorporates reductions in design speed up to 10 mph based on the design principles presented above. Design of superelevation and superelevation transitions for this category of very low-volume local roads is discussed later in this chapter.



**Guidelines for Maximum Side Friction Factor and Minimum Radius (New Construction, ADT from 250 to 400 veh/day, Limited Heavy Vehicle Traffic)**  
**Exhibit 6., page 27, AASHTO ADT<400 2001**

<b>US Customary</b>							
Design speed (mph)	Reduced design speed (mph)	Maximum design side friction factor, $f_{max}$	Minimum radius (ft), $R_{min}$				
			Max. superelevation rate (%), $e_{max}$				
			4	6	8	10	12
15	15	0.175	70	65	60	55	50
20	15	0.175	70	65	60	55	50
25	20	0.170	125	115	105	100	90
30	20	0.170	125	115	105	100	90
35	30	0.160	300	275	250	230	215
40	35	0.155	420	380	350	320	295
45	40	0.150	560	510	465	425	395
50	45	0.140	750	675	615	565	520
55	50	0.140	925	835	760	695	640
60	55	0.130	1190	1060	960	875	805

**Rural Industrial/Commercial Access, Agricultural Access, and Resource Recovery Roads**

Horizontal curves on rural industrial/commercial access, agricultural access, and resource recovery roads should be designed using the limiting values of  $f_{max}$  and  $R_{min}$  shown in Exhibit 3, whenever practical. In constrained situations, the limiting values of  $f_{max}$  and  $R_{min}$  shown in Exhibit 7 may be used. Exhibit 7 incorporates reductions in design speed up to 5 mph. Lower reductions in design speed are used for industrial/commercial, agricultural access, and resource recovery roads because these functional subclasses are more likely than other subclasses to carry substantial proportions of large trucks. Design of superelevation and superelevation transitions for this category of very low-volume local roads is discussed later in this chapter.

**Guidelines for Maximum Side Friction Factor and Minimum Radius (New Construction, ADT ≤ 400 veh/day, Substantial Proportions of Heavy Vehicle Traffic)**

**Exhibit 7., page 28, AASHTO ADT<400 2001**

US Customary							
Design speed (mph)	Reduced design speed (mph)	Maximum side friction factor, $f_{max}$	Minimum radius (ft), $R_{min}$				
			Max. superelevation rate (%), $e_{max}$				
			4	6	8	10	12
15	15	0.175	70	65	60	55	50
20	20	0.170	125	115	105	100	90
25	25	0.165	205	185	170	155	145
30	25	0.165	205	185	170	155	145
35	30	0.160	300	275	250	230	215
40	35	0.155	420	380	350	320	295
45	40	0.150	560	510	465	425	395
50	45	0.140	750	675	615	565	520
55	50	0.140	925	835	760	695	640
60	55	0.130	1190	1060	960	895	805

**Urban Major Access Streets (250 Vehicles per Day or Less) and Urban Residential Streets**

Horizontal curves on urban major access streets with average daily traffic volumes of 250 vehicles per day or less and on urban residential streets with average daily traffic volumes of 400 vehicles per day or less should be designed in accordance with the limiting values of  $f_{max}$  and  $R_{min}$  presented in Exhibit 3, whenever practical. On streets with design speeds of 45 mph or less, the design criteria in Exhibit 4 may be used in preference to Exhibit 3. In constrained situations, the limiting values of  $f_{max}$  and  $R_{min}$  shown in Exhibit 5 may be used in place of Exhibits 3 and 4. Design of superelevation and superelevation transitions for this category of very low-volume local roads is discussed later in this chapter.

**Urban Major Access Streets (250 to 400 Vehicles per Day)**

Horizontal curves on urban major access streets with average daily traffic volumes from 250 to 400 vehicles per day should be designed in accordance with the limiting values of  $f_{max}$  and  $R_{min}$  presented in Exhibit 3, whenever practical. On streets with design speeds of 45 mph or less, the design criteria in Exhibit 4 may be used in preference to Exhibit 3. In constrained situations, the limiting values of  $f_{max}$  and  $R_{min}$  shown in Exhibit 6 may be used in place of Exhibits 3 and 4. Design of superelevation and superelevation transitions for this category of very low-volume local roads is discussed later in this chapter.

## **Urban Industrial/Commercial Access Streets**

Horizontal curves on urban industrial/commercial access streets should be designed in accordance with the limiting values of  $f_{\max}$  and  $R_{\min}$  presented in Exhibit 3, whenever practical. On streets with design speeds of 45 mph or less, the design criteria in Exhibit 4 may be used in preference to Exhibit 3. In constrained situations, the limiting values of  $f_{\max}$  and  $R_{\min}$  shown in Exhibit 7 may be used in place of Exhibits 3 and 4. Design of superelevation and superelevation transitions for this category of very low-volume local roads is discussed later in this chapter.

## **Superelevation and Superelevation Transitions**

Once the radius for a particular horizontal curve has been determined, the selection of the appropriate superelevation and the design of superelevation transitions should proceed in accordance with the criteria presented in Chapter 3 of the AASHTO Policy on Geometric Design of Highways and Streets (1). Where the horizontal curve design is based on Exhibits 3 or 4, the superelevation and superelevation transition design should follow the criteria from Chapter 3 of the AASHTO Green Book for the actual roadway design speed. Where the horizontal curve design is based on Exhibits 5, 6, or 7, the superelevation and superelevation transition design follow the criteria from Chapter 3 of the AASHTO Green Book using the reduced design speed indicated in Exhibits 5, 6, or 7 in place of the roadway design speed. The criteria in Chapter 3 of the AASHTO Green Book concerning situations where no superelevation is required apply to very low-volume local roads based on the roadway design speed or the reduced design speed, as appropriate.

## **Existing Roads**

For improvement projects on existing very low-volume local roads, the existing horizontal curve geometry should generally be considered acceptable unless there is evidence of a site-specific safety problem related to horizontal curvature. The following guidelines reflect the results of the risk assessment for horizontal curves on existing roads:

For curves on very low-volume local roads with low speeds (design or estimated operating speed of 45 mph or less, reconstruction without changing the existing curve geometry and cross section is acceptable if the nominal design speed of the curve is within 20 mph of the design or operating speed, and if there is no clear evidence of a site-specific safety problem associated with the curve.

For curves on very low-volume local roads with higher speeds (design or estimated operating speed greater than 45 mph, reconstruction without changing the existing curve geometry and cross section is acceptable if

the nominal design speed of the curve is within 10 mph of the design or operating speed, and if there is no clear evidence of a site-specific safety problem associated with the curve.

Evidence of a site-specific safety problem may be: a pattern of curve-related crashes (requiring at least 5 years, and preferably 10 years, of crash history); physical evidence of curve problems such as skid marks, scarred trees or utility poles, substantial edge rutting or encroachments, etc.; a history of complaints from residents and/or local police; or measured or known speeds substantially higher (e.g., 20 mph higher) than the intended design speed. Even with such evidence, curve improvements should focus on low-cost measures designed to control speeds, enhance curve tracking, or mitigate roadside encroachment severity. Except in rare circumstances, there are more cost-effective solutions to identified curve problems on very low-volume local roads than curve flattening and reconstruction. Design actions to correct such problems should emphasize such low-cost measures and should not emphasize or encourage more costly measures such as curve flattening.

Acceptable substitutes for curve reconstruction include measures to reduce speed in the curve (signing, rumble strips, pavement markings), measures to improve the roadside within the curve (clearing slopes, widening shoulder through curve), and measures to increase pavement friction within the curve. Reconstruction employing any or all of these measures should be accompanied by appropriate before-and-after studies to monitor their effectiveness.

## **STOPPING SIGHT DISTANCE**

Sight distance is the length of roadway ahead visible to the driver. The available sight distance on a roadway should be sufficiently long to enable a vehicle traveling at or near the design speed to avoid colliding with a stationary object in its path. On higher volume highways, sight distance at every point on the highway should be at least that needed for a poorly performing driver or a poorly equipped vehicle to stop within the available sight distance. The object normally considered in stopping sight distance design is a stopped vehicle in the roadway. On local roads with extremely low traffic volumes, on which stopped vehicles would rarely be expected, provision of sufficient sight distance for a driver to maneuver around a small object on the road, rather than come to a stop, may be appropriate.

Stopping sight distance is generally determined as the sum of the two distances: (1) the distance traversed by the vehicle from the instant the driver sights an object necessitating a stop to the instant the brakes are applied; and (2) the distance required to stop the vehicle from the instant brake application begins. These are referred to as brake reaction distance and braking distance, respectively. Similarly, sight distance to maneuver around an object incorporates a maneuver reaction time and a maneuver time. The current stopping sight

distance criteria in the AASHTO Policy on Geometric Design for Highways and Streets (1) are based on the following model:

US Customary	
$d = 1.47 Vt + 1.075 \frac{V^2}{a} \quad (3)$	
<p>where:</p> <p>d = sight distance, ft;  t = brake reaction time, s;  V = design speed, mph; and  a = driver deceleration, ft/s<sup>2</sup></p>	

The brake reaction time (t) of 2.5 s used in Equation (3) represents approximately the 95th percentile of the observed distribution of brake-reaction times. The deceleration rate, a, of 11.2 ft/s<sup>2</sup> used in Equation (3) represents approximately the 10th percentile of driver deceleration rate. These values of brake reaction time and driver deceleration rate were developed in research for higher volume roads in NCHRP Report 400 (7).

As discussed later in this section, sight distance plays a key role in setting the minimum lengths of crest vertical curves. The AASHTO Policy on Geometric Design for Highways and Streets (1) uses values for height of eye (h<sub>1</sub>) and height of object (h<sub>2</sub>) equal to 3.5 ft and 2.0 ft, respectively.

Sight distance criteria applicable to new construction projects and to existing very low-volume local roads are presented below. The design criteria for stopping sight distance on very low-volume local roads vary with traffic volume levels and the proximity of intersections, narrow bridges, railroad-highway grade crossings, sharp curves and steep grades, but the design criteria do not vary between rural and urban areas or between functional subclasses or very low-volume local roads.

### New Construction

Design of newly constructed very low-volume local roads may be based on sight distances lower than those presented in the AASHTO Policy on Geometric Design for Highways and Streets (1). Very low-volume local roads may be operated safely with lower sight distances because vehicles stopped in the roadway, the primary cause of crashes associated with limited sight distance on higher volume roads, are extremely rare at low volumes and because drivers familiar with a roadway are likely to anticipate locations where vehicles might be stopped or objects in the roadway might be present.

Recent research in NCHRP Report 400 (7) found that collisions at crest vertical curves with limited sight distance are extremely rare events, even on higher volume roadways, and that the object struck in such collisions was predominately another motor vehicle. Furthermore, there was no indication that lengthening of the sight distance at crest vertical curves has any demonstrable effect on reducing the number of collisions. The risk assessment by Neuman (3) concluded that vehicles stopped in the roadway were far less likely on very low-volume local roads than even the limited likelihood of such collisions on higher volume roads and that sight distance values lower than those presented in the AASHTO Policy on Geometric Design for Highways and Streets (1) for higher volume roads can be applied to very low-volume roads with minimal effect on safety. Based on the formal risk assessment by Neuman, two sets of alternative sight distance criteria for very low-volume local roads are recommended. The maneuver sight distance model developed in NCHRP Report 400 (7) is recommended for application to:

- roads with traffic volumes of 100 vehicles per day or less

- roads with traffic volumes of 100 to 250 vehicles per day located at lower risk locations, including locations away from intersections, narrow bridges, railroad-highway grade crossings, sharp curves, and steep downgrades

The sight distance model presented in Equation (3) using alternative parameter values for brake-reaction time and driver deceleration is recommended for the following types of very low-volume local roads:

- roads with traffic volumes of 100 to 250 vehicles per day located at higher risk locations, such as locations near intersections, narrow bridges, or railroad-highway grade crossings, or in advance of sharp curves and steep downgrades

- roads with traffic volumes of 250 to 400 vehicles per day

The alternative parameter values recommended for used when Equation (3) is applied to very low-volume local roads are:

- a brake-reaction time of 2 s, based on the 90th rather than the 95th percentile of observed driver behavior

- a driver deceleration of  $13.4 \text{ ft/s}^2$ , based on the 50th percentile rather than the 10th percentile of the observed distribution

Exhibit 8 presents recommended design sight distance criteria for very low-volume local roads based on the models discussed above. These criteria may be used in design of both horizontal and crest vertical curves for new construction of very low-volume local roads.

**Design Sight Distance Guidelines for New Construction of Very Low-Volume Local Roads**  
**Exhibit 8., page 34, AASHTO ADT<400 2001**

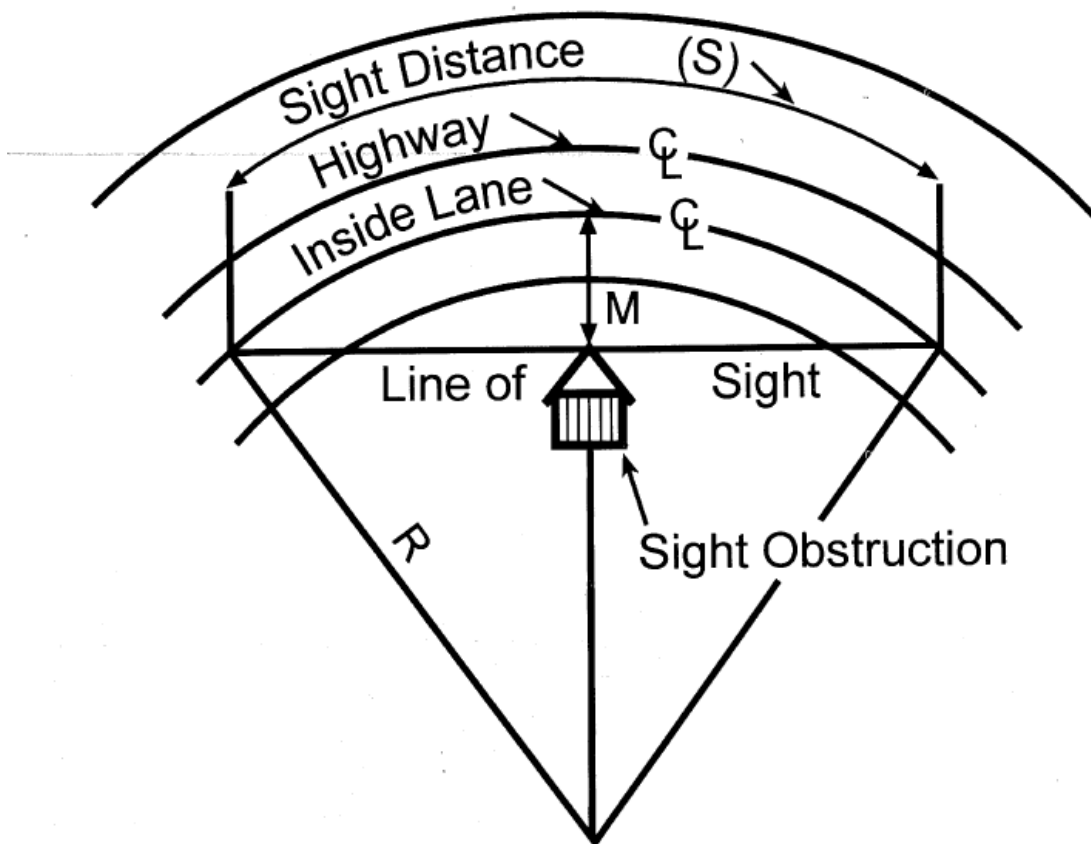
<b>US Customary</b>				
Minimum sight distance (ft) for specified design traffic volumes and location types				
Design speed (mph)	0-100 veh/day	100-250 veh/day		250-400 veh/day
	All locations	"Lower risk" locations <sup>1</sup>	"Higher risk" locations <sup>2</sup>	All locations
15	65	65	65	65
20	90	90	95	95
25	115	115	125	125
30	135	135	165	165
35	170	170	205	205
40	215	215	250	250
45	260	260	300	300
50	310	310	350	350
55	365	365	405	405
60	435	435	470	470
<sup>1</sup> away from intersections, narrow bridges, railroad-highway grade crossings, sharp curves, and steep downgrades				
<sup>2</sup> near intersections, narrow bridges, or railroad-highway grade crossings, or in advance of sharp curves or steep downgrades				

## Sight Distance on Horizontal Curves

Sight distance across the inside of horizontal curves is an element of the design of horizontal alignment. Where there are sight obstructions (such as walls, cut slopes, buildings, or longitudinal barriers) on the inside of a horizontal curve, a design to provide adequate sight distance may require an adjustment in the normal highway cross section or a change in alignment if the obstruction cannot be removed. Because of the many variables in alignment and cross sections and in the number, type, and location of possible obstructions, specific study is usually necessary for each condition. With the sight distance specified in Exhibit 8 for the appropriate design speed as a control, the designer should check the actual condition and make any necessary adjustments in the manner most fitting to provide adequate sight distances.

For general use in the design of a horizontal curve, the sight line is a chord of the horizontal curve, and the applicable stopping sight distance is measured along the centerline of the inside lane around the curve. The minimum width that should be clear of sight obstructions at any point on the curve is the middle ordinate shown in Exhibit 9. The middle ordinate for a horizontal curve can be computed, for any curve whose length exceeds the design sight distance, as shown in Equation (4):

US Customary		
$M = R$	$\left[ 1 - \cos \frac{28.65 S}{R} \right]$	(4)
where:  $M$ = middle ordinate (ft) $R$ = radius (ft) $S$ = sight distance (ft)		



**Exhibit 9. Horizontal Curve Showing Sight Distance Along the Curve and the Middle Ordinate that Defines the Maximum Unobstructed Width**

Exhibit 10 presents the middle ordinate that defines the width that should be clear of sight obstructions for a horizontal curve as a function of curve radius and design speed.





## Sight Distance on Vertical Curves

Vertical curves are provided to effect a smooth and gradual change between tangent grades and may be any one of the crest or sag types depicted in Exhibit 11. Vertical curves should be simple in application and should result in a design that is safe, comfortable in operation, pleasing in appearance, and adequate for drainage. For simplicity, the parabolic curve with an equivalent vertical axis centered on the vertical point of intersection is usually used in roadway profile design. The vertical offsets from the tangent vary as the square of the horizontal distance from the beginning of the curve.

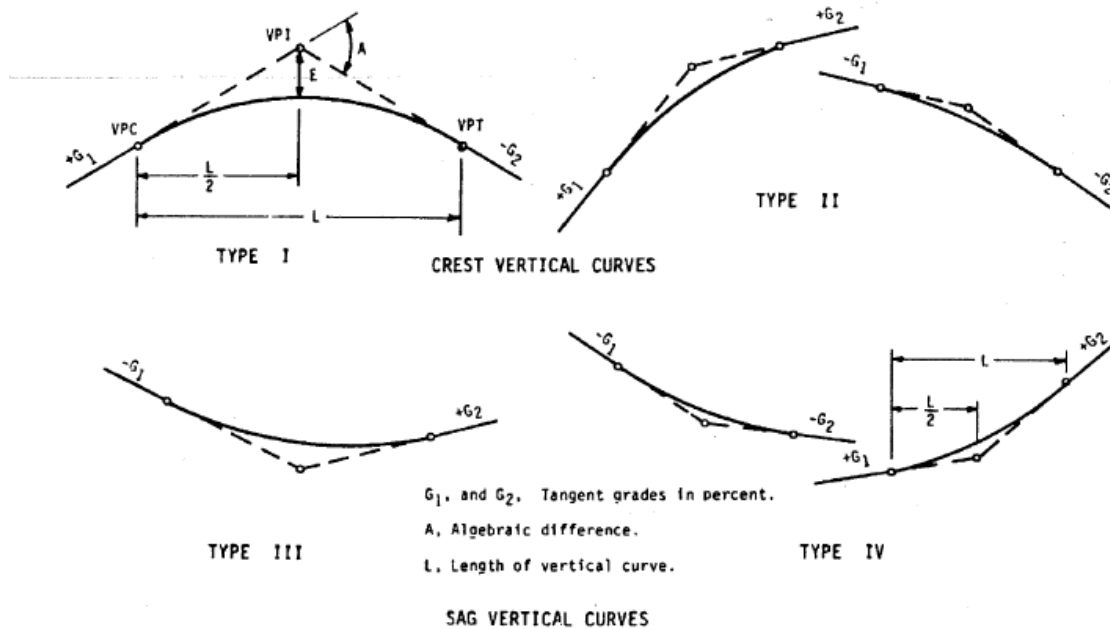


Exhibit 11. Types of Vertical Curves

### Crest Vertical Curves

The major control for safe operation on crest vertical curves is the provision of ample sight distance for the roadway design speed. In new construction of very low-volume local roads, crest vertical curves should generally be designed to have at least the length that provides the stopping sight distance values presented in Exhibit 8. These lengths can be determined as shown in Equations (5) through (8):

US Customary	
When S is less than L,	
$L = \frac{AS^2}{100 (\sqrt{2h_1} + \sqrt{2h_2})^2}$	( 5 )
When S is greater than L,	
$L = 2S - \frac{200 (\sqrt{h_1} + \sqrt{h_2})^2}{A}$	( 6 )
where:	
L = length of vertical curve, ft;	
S = sight distance, ft;	
A = algebraic difference in grades, percent;	
h <sub>1</sub> = height of eye above roadway surface, ft; and	
h <sub>2</sub> = height of object above roadway surface, ft.	

When the height of eye (h<sub>1</sub>) and height of object (h<sub>2</sub>) are 3.5 ft and 2.0 ft, respectively, as used for stopping sight distance, Equations (5) and (6) become:

US Customary	
When S is less than L,	
$L = \frac{AS^2}{2158}$	(7)
When S is greater than L,	
$L = 2S - \frac{2158}{A}$	(8)

Exhibit 12 presents the rate of vertical curvature, K, that will provide stopping sight distance for crest vertical curves on very low-volume local roads. The appropriate length for a vertical curve can generally be determined by multiplying the K-value in Exhibit 12 by the algebraic difference in grade between the adjoining tangents.

**Guidelines for Minimum Rate of Vertical Curvature to Provide Design Stopping Sight Distance on Crest Vertical Curves for New Construction of Very Low-Volume Local Roads**  
**Exhibit 12., page 39, AASHTO ADT<400 2001**

US Customary									
All locations for 0-100 vpd and "lower risk" locations for 100-250 vpd <sup>1</sup>					"Higher risk" locations for 100-250 vpd and all locations for 250-400 vpd <sup>2</sup>				
Design speed (mph)	Stopping sight distance (ft)	Rate of vertical curvature, K <sup>3</sup>		Stopping sight distance (ft)	Rate of vertical curvature, K <sup>3</sup>		Rate of vertical curvature, K <sup>3</sup>	Calculated	Design
		Calculated	Design		Calculated	Design			
15	65	2.0	2	65	2.0	2		2.0	2
20	90	3.8	4	95	4.2	5		4.2	5
25	115	6.1	7	125	7.2	8		7.2	8
30	135	8.4	9	165	12.6	13		12.6	13
35	170	13.4	14	205	19.5	20		19.5	20
40	215	21.4	22	250	29.0	29		29.0	29
45	260	31.3	32	300	41.7	42		41.7	42
50	310	44.5	45	350	56.8	57		56.8	57
55	365	61.7	62	405	76.0	76		76.0	76
60	435	87.7	88	470	102.4	103		102.4	103

<sup>1</sup> "lower risk" locations are locations away from intersections, narrow bridges, railroad-highway grade crossings, sharp curves, and steep grades

<sup>2</sup> "higher risk" locations are locations near intersections, narrow bridges, or railroad-highway grade crossings, or in advance of sharp curves or steep downgrades

<sup>3</sup> the rate of vertical curvature, K, is the length of curve (L) per percent algebraic difference in intersecting grades (A); i.e.,  $K = L/A$

## **Sag Vertical Curves**

There are no special guidelines for design of sag vertical curves on very low-volume local roads. Sag vertical curves should generally be designed in accordance with Chapter 5 of the AASHTO Policy on Geometric Design for Highways and Streets (1).

### **Existing Roads**

Given the geometry of stopping sight distance on horizontal and crest vertical curves, the costs for even marginal or incremental improvements make reconstruction of very low-volume local roads to increase stopping sight distance not cost-effective except in unusual cases. Research NCHRP Report 400 (7) found that, even on higher volume roadways, accidents associated with limited sight distance are extremely rare events. Furthermore, there was no indication that lengthening of the sight distance of a crest vertical curve has any demonstrable effect on reducing the number of collisions. Collisions related to limited sight distance are even less likely on very low-volume local roads than on the higher volume roads studied in NCHRP Report 400 (7).

Because sight distance improvements are unlikely to be cost-effective under most circumstances, the existing sight distance on a very low-volume local road may be allowed to remain in place unless there is evidence of a site-specific safety problem attributable to inadequate sight distance. If a site-specific safety problem is identified, and if the designer finds after investigation that the safety problem is attributable to limited sight distance, then the sight distance of the specific horizontal or vertical curve(s) at which the problem is present should be upgraded to at least the sight distance levels shown in Exhibit 8 as part of any reconstruction project undertaken. Sight distance could be increased to the full criteria presented in the AASHTO Policy on Geometric Design for Highways and Streets (1) where the judgment of the designer indicates that this is appropriate. This approach is intended to provide maximum flexibility to the designer in assessing site-specific conditions and exercising informed judgment to decide whether a correctable problem is present or not. Guidance concerning identification of site-specific safety problems is found in Chapter 3 of these guidelines.

## **INTERSECTION SIGHT DISTANCE**

### **General Considerations**

Each intersection has the potential for several different types of vehicle-vehicle conflicts. The possibility of these conflicts actually occurring can be greatly reduced through the provision of proper sight distances and appropriate traffic controls. The avoidance of crashes and the efficiency of traffic operations still depend on the judgment, capabilities, and response of each individual driver.

The driver of a vehicle approaching an at-grade intersection should have an unobstructed view of the entire intersection, including any intersection traffic-control devices, and sufficient lengths of the intersecting road to permit the driver to anticipate and avoid potential collisions. The sight distance that should be used for design under various assumptions of physical conditions and driver behavior is directly related to vehicle speeds and to the resultant distances traversed during perception-reaction time and braking.

Guidelines for intersection sight distance at intersections between very low-volume local roads are presented here. However, if one or more of the intersection legs has a design traffic volume that exceeds 400 vehicles per day, intersection sight distance should be designed in accordance with Chapter 9 of the AASHTO Policy on Geometric Design for Highways and Streets (1).

Stopping sight distance is provided continuously along each road or street so that drivers have a view of the roadway ahead that is sufficient to allow drivers to stop, if necessary, under prescribed conditions. The provision of stopping sight distance at all locations along each road or street, including intersection approaches, is fundamental to safe intersection operations.

Vehicles are assigned the right-of-way at intersections by traffic-control devices or, where no traffic-control devices are present, by the rules of the road. A basic rule of the road is that, at an intersection at which no traffic-control devices are present, the vehicle on the left must yield the right-of-way to the vehicle on the right if they arrive at approximately the same time. Sight distance is provided at intersections to allow the drivers of vehicles without the right-of-way to perceive the presence of potentially conflicting vehicles in sufficient time for the vehicle without the right-of-way to stop, if necessary, before reaching the intersection. The methods for determining the sight distances needed by drivers approaching intersections are based on the same principles as stopping sight distance, but incorporate modified assumptions based on observed driver behavior at intersections.

Sight distance is also provided at intersections to allow the drivers of vehicles stopped on intersection approaches a sufficient view of the intersecting highway to decide when to turn onto the intersecting highway or to cross it from a stop- or yield-controlled approach to an intersection that has both controlled and uncontrolled approaches. If the available sight distance for an entering or crossing vehicle is at least equal to the appropriate stopping sight distance for the uncontrolled approach, then drivers should have sufficient sight distance to anticipate and avoid collisions. However, in some cases, this may require a vehicle on an uncontrolled approach to stop or slow to accommodate a running maneuver by a vehicle from a controlled approach. Intersections between two very low-volume local roads can be operated safely with approach sight distances based on stopping sight distances. To achieve better traffic

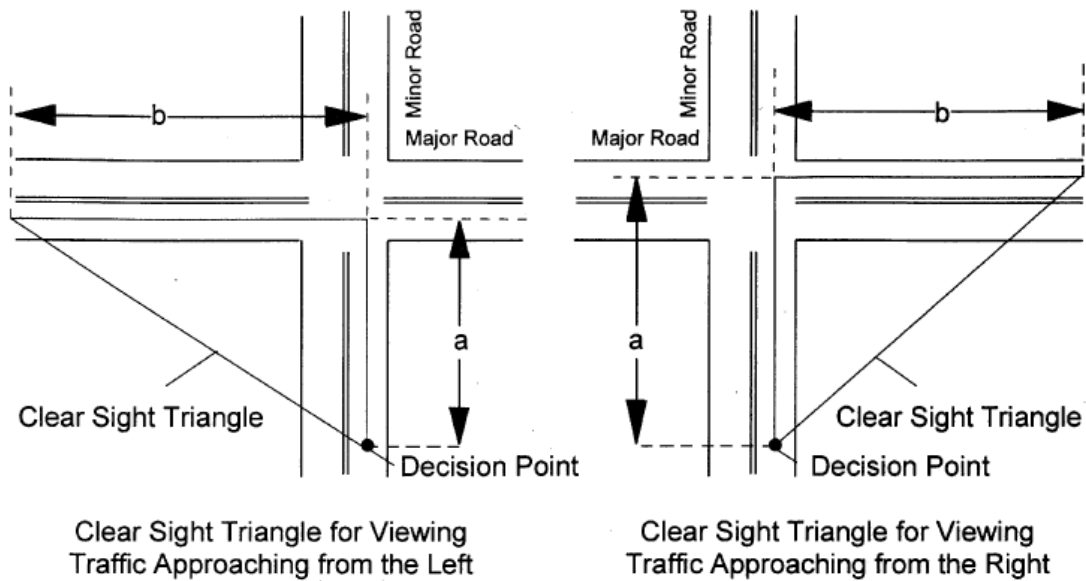
operations, so that vehicles on uncontrolled approaches do not need to stop or slow substantially to accommodate entering or crossing vehicles, intersection sight distances that exceed stopping sight distance are desirable along the uncontrolled approaches. Thus, intersection sight distances that exceed stopping sight distance are intended to enhance traffic operations, but are not minimum design criteria that are essential to safety.

### **Clear Sight Triangles**

Specified areas along intersection approach legs and across their included corners should be clear to obstructions that might block a driver's view of potentially conflicting vehicles. These specified areas are known as clear sight triangles. Two types of clear sight triangles considered in intersection design, approach sight triangles and departure sight triangles, are explained below. The dimensions of the clear sight triangles depend on the design speeds of the intersecting roadways and the type of traffic control used at the intersection. These dimensions are based on field studies in NCHRP Report 383 (6) that have observed driver behavior and have documented the space-time profiles and the speed choices of drivers on intersection approaches.

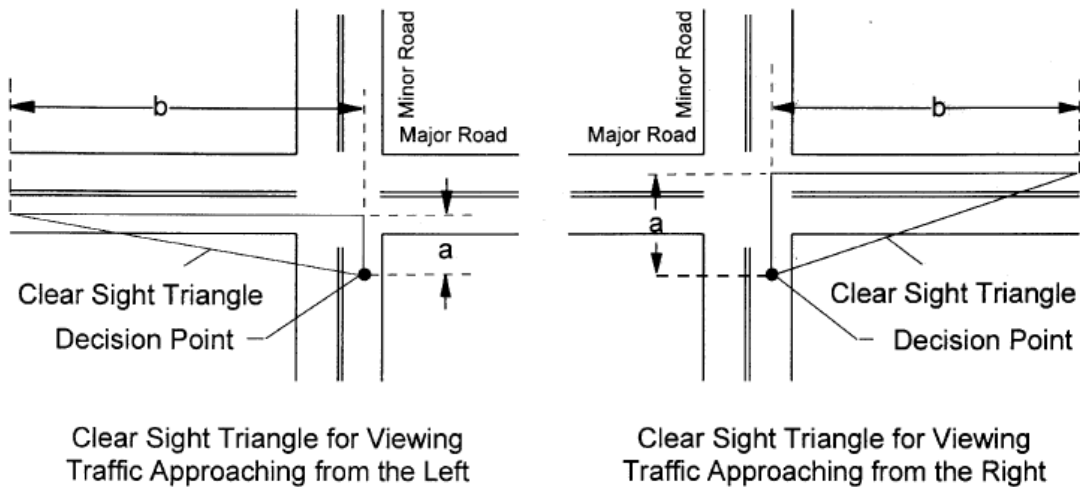
### **Approach Sight Triangles**

Each quadrant of an uncontrolled or yield-controlled intersection should contain a clear sight triangle free of obstructions that might block an approaching driver's view of potentially conflicting vehicles on the intersecting approaches. The area clear of sight obstructions should include sufficient lengths of both intersecting roadways, as well their included corner, so that the drivers without the right-of-way can see any potentially conflicting vehicle in sufficient time to slow or stop before reaching the intersection. Exhibit 13A shows typical clear sight triangles to the left and to the right for a vehicle approaching an intersection.



2000.153-2z

**A -- Approach Sight Triangles**



**B -- Departure Sight Triangles**

### Exhibit 13. Clear Sight Triangles for Intersection Approaches

The vertex of the sight triangle on the uncontrolled or yield-controlled approach represents a decision point for the approaching driver. This decision point is the location at which the driver should begin to brake to a stop if another vehicle is present on an intersecting approach.



The geometry of a clear sight triangle is such that when the driver of a vehicle without the right-of-way sees a potentially conflicting vehicle on an intersecting approach that has the right-of-way, then the driver of that potentially conflicting vehicle can also see the first vehicle. Thus, the provision of a clear sight triangle for vehicles without the right-of-way also permits the drivers of vehicles with the right-of-way to be prepared to slow, stop, or avoid other vehicles, should it become necessary.

Approach sight triangles like those shown in Exhibit 13A are not needed for intersection approaches controlled by stop signs because all approaching vehicles are required to stop at the intersection, regardless of the presence or absence of vehicles on the intersecting approaches.

### **Departure Sight Triangles**

A second type of clear sight triangle provides sight distance sufficient for a driver stopped on a stop- or yield-controlled approach to depart from the intersection by entering or crossing the intersecting road. Exhibit 13B shows typical departure sight triangles to the left and to the right. Departure sight triangles should be provided in each quadrant of each intersection approach controlled by stop or yield signs from which stopped vehicles may enter or cross a road on which traffic is not required to stop.

### **Identification of Sight Obstructions within Clear Sight Triangles**

The profiles of the intersecting roadways should be designed to provide the recommended sight distances for drivers on the intersection approaches. Within a clear sight triangle, any object at a height above the elevation of the adjacent roadways that would obstruct the driver's view such as highway structures, roadside hardware, hedges, trees, bushes, unmowed grass, and tall crops, should be removed or lowered, if practical. Such objects may include: buildings, parked vehicles, terrain itself.

The determination of whether an object constitutes a sight obstruction should consider the horizontal and vertical alignment of both intersecting roadways, as well as the height and position of the object. In making this determination, it should be assumed that the driver's eye is 3.5 ft above the roadway surface and that the object to be seen is also 3.5 ft above the surface of the intersecting road. This object height is based on a vehicle height of 4.4 ft, which represents the 15th percentile of vehicle heights in the current passenger car population less an allowance of 0.9 ft, which represents a near-maximum value for the portion of the vehicle height that needs to be visible for another driver to recognize a vehicle as such. The use of an object height equal to the driver eye height makes intersection sight distances reciprocal (i.e., if one driver can see another vehicle, then the driver of that vehicle can also see the first vehicle).

## **New Construction**

Sight distance design for newly constructed intersections at which all intersection legs are very low-volume local roads should be based on the criteria presented below. If one or more of the intersection legs has a design volume that exceeds 400 vehicles per day, the sight distance criteria in Chapter 9 of the AASHTO Policy on Geometric Design for Highways and Streets (1) should be applied.

The sight distance design criteria for intersections between very low-volume local roads vary with the type of traffic control used at an intersection because different types of control impose different legal constraints on drivers and, therefore, result in different driver behavior. Sight-distance policies for intersections with the following types of traffic control are presented below:

Intersections with no control (Case A)

Intersections with stop control on the minor road (Case B)

Intersections with yield control on the minor road (Case C)

### **Intersections with No Control (Case A)**

For intersections not controlled by yield signs, stop signs, or traffic signals, the driver of a vehicle approaching the intersection must be able to see potentially conflicting vehicles on intersecting approaches in sufficient time for the approaching driver to safely stop before reaching the intersection. The location of the vertex of the sight triangles on each approach is determined from a model that is analogous to the stopping sight distance model, with slightly different assumptions. Drivers of approaching vehicles may require up to 2.5 s to perceive vehicles on intersecting approaches and to initiate braking.

While some perceptual tasks at intersections may require substantially less time, the detection and recognition of a vehicle that is a substantial distance away on an intersecting approach, and is near the limits of the driver's peripheral vision, may require up to 2.5 s. The distance to brake to a stop can be determined from the same braking coefficient used for stopping sight distance design.

Field observations in NCHRP Report 383 (6) indicate that vehicles approaching uncontrolled intersections typically slow down from their running speed between intersections to approximately 50 percent of their running speed. This occurs even when no potentially conflicting vehicles are present. This initial slowing typically occurs at deceleration rates up to  $5 \text{ ft/s}^2$ , deceleration at this gradual rate has been observed to begin even before a potentially conflicting vehicle comes into view. Braking at greater deceleration rates, which can approach those assumed in stopping sight distance, begins up to 2.5 s after a vehicle on the intersecting approach comes into view. Thus, approaching vehicles may be

traveling at less than their midblock running speed during all or part of the perception-reaction time and can, therefore, where necessary, brake to a stop from a speed less than the midblock running speed.

Exhibit 14 shows the distance traveled by an approaching vehicle during perception-reaction and braking time as a function of the design speed of the roadway on which the intersection approach is located. These distances should be used as the legs of the sight triangles shown in Exhibit 13A. Referring to Exhibit 13A, roadway A with a 50 mph design speed and roadway B with a 30 mph design speed require a clear sight triangle with legs extending at least 255 ft and 120 ft along roadways A and B, respectively.

**Recommended Sight Distance Guidelines for New Construction of Intersections with No Traffic Control (Case A) (1,6)**

**Exhibit 14., page 45, AASHTO ADT<400 2001**

US Customary	
Design speed (mph)	Sight distance (ft)
15	60
20	80
25	95
30	120
35	140
40	170
45	210
50	255
55	300
60	350
Note: For approach grades greater than 3%, multiply the sight distance value by the appropriate adjustment factor from Exhibit 15.	

This clear sight triangle will permit the vehicles on either road to stop, if necessary, before reaching the intersection. If the design speed of any approach is not known, it can be estimated by using the 85th percentile of the running speeds between intersections for that intersection leg.

The distances shown in Exhibit 14 are generally less than the corresponding values of stopping sight distance for the same design speed. Where a clear sight triangle whose legs correspond to the stopping sight distances of their respective approaches can be provided, this will provide an even greater margin of safety. However, since field observations show that motorists slow down to some extent on approaches to uncontrolled intersections, the provision of a clear sight triangle with legs equal to the full stopping sight distance is not essential.

Where the grade along an intersection approach exceeds 3 percent, the leg of the clear sight triangle along that approach should be adjusted by multiplying the appropriate sight distance from Exhibit 14 by the appropriate adjustment factor from Exhibit 15 (SEE NOTE ON FOLLOWING PAGE).

NOTE: “Guidelines for Geometric Design of Very Low-Volume Local Roads (ADT  $\leq$  400)” contains an error. Exhibit 15 is identical to Exhibit 14 and is therefore not included in Appendix 1.

If the sight distances given in Exhibit 14, as adjusted for grades, cannot be provided, consideration should be given to installing advisory speed signing to reduce speeds or installing stop signs on one or more approaches.

No departure sight triangle like that shown in Exhibit 13B is needed at an uncontrolled intersection because of the very low traffic volumes present on the intersection approaches.

If a motorist finds it necessary to stop at an uncontrolled intersection because of the presence of a conflicting vehicle on an intersecting approach, it is very unlikely that another potentially conflicting vehicle will be encountered as the first vehicle departs the intersection.

### **Intersections with Stop Control on the Minor Road (Case B)**

No approach sight triangles like those shown in Exhibit 13A are needed on stop-controlled approaches because all vehicles on the approach are required to stop before entering or crossing the intersecting road.

Departure sight triangles to the left and the right like those shown in Exhibit 13B should be provided for each stop- or yield-controlled approach. Whenever practical, a leg of the departure sight triangle along each uncontrolled approach equal to at least the full intersection sight distance for stop-controlled intersections, as presented in Chapter 9 of the AASHTO Policy on Geometric Design for Highways and Streets (1), should be provided. In constrained situations, the length of the leg of the departure triangle along the major road should be at least equal to the stopping sight distance appropriate for the design speed of the major road as determined from Exhibit 8. For the traffic volume range from 100 to 250 vehicles per day, the sight distances in the column of Exhibit 8 headed “higher risk” locations should be used, because this column is appropriate for application to intersections. The vertex of the departure sight triangle on the minor road should be 14.4 ft from the edge of the major-road traveled way (1,6).

### **Intersections with Yield Control on the Minor Road (Case C)**

Approach sight triangles to the left and to the right like those shown in Exhibit 13A should be provided for each yield-controlled intersection approach. Whenever practical, legs of the approach sight triangles equal to at least the full intersection sight distances for yield-controlled intersections, as presented in Chapter 9 of the AASHTO Policy on Geometric Design for Highways and Streets

(1), should be provided. In constrained situations, the leg of the approach sight triangle along each intersection approach should be at least equal to the stopping sight distance appropriate for the design speed of that approach as determined from Exhibit 8. For the traffic volume range from 100 to 250 vehicles per day, the sight distances in the column of Exhibit 8 headed “higher risk” locations should be used because this column is appropriate for application to intersections. The grade adjustment factors in Exhibit 15 (EXHIBIT 15 NOT INCLUDED – SEE NOTE ON PREVIOUS PAGE) also apply to this case.

No separate departure sight triangles for yield-controlled intersections need be considered. The approach sight triangles for yield-controlled intersections described above include departure sight triangles equivalent to those described earlier for stop-controlled intersections on very low-volume local roads.

### **Existing Roads**

For improvement projects at existing intersections between very low-volume local roads, the existing intersection sight distance may generally remain in place unless there is evidence of a site-specific safety problem related to intersection sight distance. Where there is evidence of a site-specific safety problem, the intersection sight distance should be increased to at least the appropriate values shown above for new construction.

### **ROADSIDE DESIGN**

Two key aspects of roadside design are clear zone width and traffic barrier warrants. AASHTO policy on these aspects of roadside design for higher volume roads is presented in the AASHTO Roadside Design Guide (2). Specific roadside design policies for higher volume local roads are also presented in Chapter 5 of the AASHTO Policy on Geometric Design for Highways and Streets (1). This section presents guidelines for roadside design on very low-volume local roads that may be used in lieu of these other AASHTO policies and guidelines. For design issues not addressed in this guide, the designer should consult the applicable sections of these other AASHTO policies and guidelines.

A clear zone is that portion of the roadside that is free of obstructions and sufficiently flat to enable an errant vehicle to encroach without overturning. The clear zone width at any point along the roadway is measured from the edge of the traveled way to the nearest obstruction or the beginning of a non-traversable slope. Thus, shoulders are part of the roadside clear zone.

A traffic barrier is a device used to prevent a vehicle from striking a more severe obstacle or feature located on the roadside. Traffic barriers include roadside barriers, median barriers, bridge railings, and crash cushions.

The roadside design is the one major determinant of safety on very low-volume local roads, if for no other reason than that multiple-vehicle collisions on the roadway are rare. Both the safety literature and the risk assessment conducted by Neuman (3) indicate that run-off-road crashes on roads with very low traffic volumes occur so infrequently as to make any minimum clear zone width demonstrably not cost-effective. In many cases, the provision of additional clear zone width increases construction costs and requires additional right-of-way acquisition which potentially has both cost and environmental concerns.

Research has found that roadside clear zones provide very little benefit, and that traffic barriers are not generally cost-effective, on roads with very low traffic volumes (9, 10, 11). However, there are no established criteria to identify those limited situations where provision of a roadside clear zone or a traffic barrier may be warranted. Therefore, the roadside design guidelines for very low-volume local roads provide great flexibility to the designer in exercising engineering judgment to decide whether it is appropriate to provide improved roadsides.

### **New Construction**

Roadside design guidelines applicable to new construction of very low-volume local roads are presented below. The guidelines address both clear zone width and traffic barrier warrants and are appropriate for all functional classes of very low-volume local roads.

#### **Clear Zone Width**

The risk assessment discussed in Section 3 of this guide found that it is not generally cost-effective to provide clear zones, also known as clear recovery areas, on very low-volume local roads. Nevertheless, a clear zone of any width should provide some contribution to safety. Thus, where clear zones can be provided on very low-volume local roads at little or no additional cost, their incorporation in designs should be considered. However, major expenditures to provide clear zones will generally have only limited safety benefits and are unlikely to be cost-effective. The design guidelines for roadside clear zone width on very low-volume local roads are as follows:

1. At locations where a clear recovery area of 6 ft or more in width can be provided at low cost and with minimum social/environmental impacts, provision of such a clear recovery area should be considered.
2. Where constraints of cost, terrain, right of way, or potential social/environmental impacts make the provision of a 6-ft clear recovery area impractical, clear recovery areas less than 6 ft in width may be used, including designs with 0 ft clear recovery areas.

3. In all cases, designers should be encouraged to tailor the roadside design to site-specific conditions, considering cost-effectiveness and safety tradeoffs. For example, the use of adjustable clear zone widths, such as providing wider clear zone dimensions at sharp horizontal curves where there is a history of run-off-road crashes, or where there is evidence of vehicle encroachments such as scarring of trees or utility poles, may be appropriate. Lesser values of clear zone width may be appropriate on tangent sections of the same roadway.
4. Other factors for consideration in analyzing the need for providing clear zones include the crash history, the expectation for future traffic volume growth on the facility, and the presence of vehicles wider than 8.5 ft and vehicles with wide loads, such as farm equipment.

In summary, the designer should provide a clear zone as wide as practical within constraints of cost, terrain, right of way, or potential social/environmental impacts. Where provision of a clear zone is not practical, none is required. Site-specific conditions and the engineering judgment of the designer should be the two primary determinants of the appropriate clear zone width for very low-volume local roads.

### **Traffic Barriers**

The use of guardrail or other traffic barriers to shield or protect drivers from roadside obstructions is not generally cost-effective for very low-volume local roads. This finding has been confirmed in studies by Stephens (9) and Wolford and Sicking (10). Guardrail itself is a roadside obstacle, and a significant proportion of vehicle impacts with guardrail produce injuries. The costs to maintain guardrail and the low frequency of collisions with guardrail that is provided generally make it impractical for use on roads with very low traffic volumes. Despite the general lack of cost effectiveness for guardrail on very low-volume local roads, designers may exercise engineering judgment concerning the placement of guardrail at locations where the potential consequences of departure from the roadway are likely to be extremely severe.

### **Existing Roads**

The roadside design guidelines for existing very low-volume local roads are the same as those for newly constructed roads. Roadside clear zones and traffic barriers are not generally cost effective and need not generally be provided, except in situations where the engineering judgment of the designer identifies a need for the provision of a roadside clear zone or a guardrail. Evidence of a site-specific safety problem that could indicate the desirability of providing a roadside clear zone or a guardrail can include reported crashes or evidence of roadside

encroachments. However, both roadside encroachments and crashes are generally very rare on very low-volume local roads.

## **UNPAVED ROADS**

Many low-volume local roads have unpaved surfaces. Unpaved roads are generally appropriate for all functional subclasses of very low-volume local roads. Major access roads often have paved surfaces because they serve higher traffic volumes, but this is not considered mandatory. In particular, resource recovery (e.g., logging) roads and agricultural access roads in rural areas are frequently unpaved. Provision of an unpaved surface is an economic decision that is appropriate for many very low-volume local roads for which the cost of constructing and maintaining a paved surface would be prohibitive.

The safety of unpaved roads has been addressed in NCHRP Report 362 (5). This research established that crash rates are generally higher for unpaved roads than for paved roads for traffic volumes of 250 vehicles per day or more. The risk assessment by Neuman (3) found that roads in rural areas generally reach the threshold at which paving the road would be expected to result in one less severe crash every 10 to 15 years in the traffic volume range between 300 to 350 vehicles per day. However, there are no specific guidelines that indicate the maximum traffic volume level for which unpaved surfaces are appropriate.

NCHRP Report 362 (5) found crash rates for unpaved roads to be lower for narrower roadway widths. Therefore, existing unpaved roads should not generally be widened as a safety measure unless there is evidence of a site-specific safety problem that may be corrected by widening.

Unpaved roads are intended to operate at low to moderate speeds. Design speeds for unpaved roads should normally be 45 mph or less, but may occasionally be as high as 50 mph in situations the designer considers appropriate.

Provision of roadside clear zones, flatter slopes, or traffic barriers is generally inconsistent with the economic decision to build and maintain an unpaved surface and is not generally necessary for the low-speed environment of an unpaved road.

Design of horizontal alignment on unpaved roads differs from paved roads because paved and unpaved roads have different surface friction characteristics and because unpaved roads are typically designed for low-speed operation.

Exhibit 16 presents guidelines for the minimum radius of curvature for unpaved surfaces with no superelevation for application on very low-volume local roads. The exhibit is based on the design criteria of the United States Forest Service



(11), which operates many unpaved roads. The minimum radius of curvature is a function of traction coefficient, which in turn is a function of the surface type (earth, gravel, crushed rock, packed snow, etc.) and the surface condition (dry, wet, ice, etc.) as shown in Exhibit 17. The recommended minimum curve radii in Exhibit 16 are based on use of a side friction factor,  $f$ , in Equation (2) that is 0.2 less than the traction coefficients shown in Exhibit 17. Use of high values of friction coefficient for design allows the designer to select smaller curve radii than would otherwise be used. Of course, the selection of a high traction coefficient is consistent with a higher surface type, and/or with an assumption that poor surface conditions such as snow, ice, or wet pavement are not sufficiently frequent for use as a design control. The choice of the appropriate surface condition from Exhibit 17 should be based on the engineering judgment of the designer based on site-specific conditions.

Smaller curve radii than those shown in Exhibit 16 may be used where superelevation is provided. The minimum radius of curvature for such cases can be determined with Equation (2).

When an existing unpaved road is to be paved, a review of all geometric design elements of the road should be undertaken to assess their suitability for the higher speeds that are likely on a paved road.

**Guidelines for Minimum Radius of Curvature for New Construction of Unpaved Surfaces with No Superelevation (11)**

**Exhibit 16., page 51, AASHTO ADT<400 2001**

Design speed (mph)	US Customary				
	Minimum radius (ft) for specified traction coefficient				
	0.7	0.6	0.5	0.4	0.3
15	50	50	50	75	150
20	55	70	90	135	270
25	85	105	140	210	420
30	120	150	200	300	600
35	165	205	275	410	820
40	215	270	360	535	1070
45	270	340	450	675	1350
Source: Adapted from USFS Preconstruction Handbook (11)					

**Traction Coefficients Used in Design of Horizontal Alignment on Unpaved Roads (11)**  
**Exhibit 17., page 51, AASHTO ADT<400 2001**

Material	Surface Condition		
	Dry	Wet	Other
Gravel, packed, oiled	0.50 - 0.85	0.40 - 0.80	-
Gravel, loose	0.40 - 0.70	0.36 - 0.75	-
Rock, crushed	0.55 - 0.75	0.55 - 0.75	-
Earth <sup>a</sup>	0.55 - 0.65	0.40 - 0.50	-
Dry, packed snow	-	-	0.20 - 0.55
Loose snow	-	-	0.10 - 0.60
Snow, lightly salted	-	-	0.29 - 0.31
Snow, lightly salted with chains	-	-	0.34
Ice, without chains	-	-	0.07 - 0.12
<sup>a</sup> reduce earth values by 50 percent for wet clays			
Source: Adapted from USFS Preconstruction Handbook (11)			

## **TWO-WAY SINGLE-LANE ROADS**

Two-way single-lane roads may be used in constrained locations, where traffic volumes are extremely low. Such cross sections are normally used on local roads where traffic volumes are less than 50 vehicles per day. On resource recovery roads used by professional drivers who are often in contact with one another by radio, two-way single-lane roads may be used for traffic volumes up to 100 vehicles per day. Two-way single-lane roads are designed to operate at low speeds, typically no more than 30 mph.

Two-way single-lane roads are often unpaved and normally have widths in the range from 11.5 to 13.0 ft. Design values of stopping sight distance for two-way single-lane roads should be twice the stopping sight distance for a comparable two-lane road, as shown in Exhibit 8. USFS guidelines recommend that turnouts be provided at regular intervals on two-way single-lane roads to allow opposing vehicles to pass one another safely (11). The location of turnouts should consider topography and horizontal and vertical alignment. In some cases, particularly where increased sight distances are impractical, widening of the roadway at crests should be considered.

## **REFERENCES**

1. AASHTO. *A Policy on Geometric Design of Highways and Streets*. Washington, D.C.: 2001.
2. AASHTO. *Roadside Design Guide*, Washington, D.C.: January 1996.
3. Neuman, T. R. "Design Guidelines for Very Low-Volume Local Roads (<400 ADT)," final report of NCHRP Project 20-7(75), CH2M Hill Chicago, Illinois: May 1999.
4. Transportation Research Board. *Designing Safer Roads: Practices for Resurfacing, Restoration, and Rehabilitation*, Special Report 214, Washington, D.C.: 1987.

5. Zegeer, C.V., R. Stewart, F. Council, and T.R. Neuman, *Roadway Widths for Low-Traffic-Volume Roads*, NCHRP Report 362, Transportation Research Board. Washington, D.C.: 1994.
6. Harwood, D. W., J. M. Mason, R. E. Brydia, M. T. Pietrucha, and G. L. Gittings, *Intersection Sight Distance*, NCHRP Report 383, Transportation Research Board. Washington, D. C.: 1996.
7. Fambro, D., K. Fitzpatrick, and R. J. Koppa, *Determination of Stopping Sight Distances*, NCHRP Report 400, Transportation Research Board. Washington, D. C.: 1997.
8. Zegeer, C.V., R. Stewart, D. Reinfurt, F. M. Council, T. Neuman, E. Hamilton, T. Miller, and W. Hunter, *Cost Effective Geometric Improvements for Safety Upgrading of Horizontal Curves*, Report No. FHWA-RD-90-021. Federal Highway Administration. McLean, VA: October 1991.
9. Stephens, L. B., "Guardrail Warrants for Low-Volume Roads," in Transportation Research Circular 416, *Issues Surrounding Highways and Roadside Safety Management*. Washington, D. C.: October 1993.
10. Wolford, D., and D. L. Sicking, "Guardrail Need: Embankments and Culverts," *Transportation Research Record 1599*. Transportation Research Board. Washington, D. C.: 1997.
11. United States Forest Service. *Road Preconstruction Handbook*, Publication FSH 7709.56. U.S. Department of Agriculture. May 1987.
12. Transportation Association of Canada, *Manual of Geometric Design Standards for Canadian Roads*. Ottawa, 1986.
13. Institute of Transportation Engineers, *Recommended Guidelines for Subdivision Streets*. Washington, D. C.: 1993.



---

## APPENDIX 2

---

### **REQUIRED FORMS AND PROCEDURES FOR ACQUISITION OF RIGHT OF WAY FOR FEDERALLY ASSISTED PROJECTS**

#### **INFORMATION AND INSTRUCTIONS FOR LOCAL GOVERNMENTS PROVIDED BY THE SOUTH DAKOTA DEPARTMENT OF TRANSPORTATION OFFICE OF LOCAL TRANSPORTATION PROGRAMS**

**FOR ADVICE AND/OR ASSISTANCE ON ANY PHASE OF RIGHT OF WAY  
ACQUISITION AS WELL AS TO REQUEST THE FORMS, PLEASE CALL US  
AT 773-3574**

---

All projects funded with federal funds must have right-of-way (ROW) acquired in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 as amended (The Uniform Act). The Uniform Act protects individuals by insuring that they are provided just compensation when their private property is given up for public projects. The Uniform Act also provides moving expense payments, and relocation assistance and payments to individuals who must move from or move personal property from acquired land. The Uniform Act provisions must be followed whenever federal funds are used on any phase (e.g., Preliminary Engineering, Right-of-Way, or Construction) of a highway construction project, even if there are no federal funds in the Right-of-Way phase.

Local government federal aid projects usually have ROW acquisition handled by the local government without federal funds. This is done as a matter of practice on bridge replacements and for cost effectiveness on grading projects. When the local government acquires ROW, Uniform Act requirements must be followed. Documentation must be provided before the project can be advertised for bids.

The local government may ask the landowner for donations. However, the property owner must be made aware that he/she is entitled to full compensation for the property acquired for a Federal-aid project. If the owner will be asked to donate, the following form must be used.

**LGA-ROW-1, AGREEMENT FOR VOLUNTARY RIGHT-OF-WAY  
DONATION AND RECORD OF CALLS/VISITS AND  
DISCUSSION RECORD:** When a landowner signs this form, the right to an appraisal and an offer of just compensation is waived. If there are conditions to the donation, they should be documented on the form in the space provided for "Stipulations of conditional donations". Conditions might relate to the location of an entrance or some special construction feature. When signed, the local

government shall maintain the original and the landowner and Local Transportation Programs Office shall each receive a copy of this form. When asking for donations, no attempts may be made to coerce the landowner. Donations are strictly voluntary. The second page of this document is a record of calls/visits which must also be filled out to record who contacted the landowner and what was discussed during each call and/or meeting. A copy of this form must be returned to this office with each copy of the signed donation form.

The local government may also ask for acquisition of the property from the landowner by established payment. However, the property owner must be made aware that he/she is entitled to full compensation for the property acquired for a Federal-aid project. If the owner will be asked for the acquisition by established payment, the following form must be used.

**LGA-ROW-2, AGREEMENT FOR VOLUNTARY RIGHT OF WAY ACQUISITION BY ESTABLISHED PAYMENT AND RECORD OF CALLS/VISITS AND DISCUSSION RECORD:** When a landowner signs this form, the right to an appraisal and an offer of just compensation is waived. The established payment is determined by the County and can be the same amount or different amounts for the two types of easements. When signed, the local government shall maintain the original and the landowner and Local Transportation Programs Office shall each receive a copy of this form. When asking for acquisition by established payment, no attempts may be made to coerce the landowner. Acquisitions by established payment are strictly voluntary. The second page of this document is a record of calls/visits which must also be filled out to record who contacted the landowner and what was discussed during each call and/or meeting. A copy of this form must be returned to this office with each copy of the signed acquisition by established payment form.

If donations or acquisitions by established payment are not obtained, an estimate of value must be made and the land purchased. Negotiations must be conducted free of any attempt to coerce the property owner into reaching an agreement. For example, the negotiator should be careful not to imply that the negotiation, and in particular the offer, is a “take it or leave it” proposition. Similarly, the use of condemnation as a threat must be avoided. Other examples of actions the acquiring agency must avoid include: advancing the time of condemnation; deferring negotiations; or delaying the deposit of funds with the courts to coerce an agreement with the property owner. The following forms and procedures are for uncomplicated purchases involving parcels valued below \$10,000. Use of these forms and procedures are mandatory and are intended to ensure that the

property is being acquired in accordance with the Uniform Act. They are also intended to ensure that landowners are treated equally and fairly.

**LGA-ROW-3, ESTIMATE OF VALUE:** An Estimate of Value has to be completed for each parcel. The Director of Equalization is probably best qualified to complete the form. The usual basis of valuation for permanent easements is the 'per acre', or 'per square foot', value of recent sales of similar properties. The value of any improvements in the acquisition must also be included in the estimate. The usual basis of the valuation for temporary easement is the prevailing cash rental rates of similar properties. This is normally for one year for cultivated land but could be for more years for pasture land that may require several years for re-establishment of grass. There is a separate line item for fence in the acquisition. Federal funds may be used to construct new fence as part of the contract providing the landowner is first given the option of being paid for the fence in the acquisition. If the landowner elects to be paid for the fence in the acquisition, the landowner is then responsible for any construction of any replacement fence. The Administrative Approval block on the form is for the signature of the County Highway Superintendent / City Engineer. When signed, the local government shall maintain the original and the Local Transportation Programs Office shall receive a copy of this form.

**LGA-ROW-4, WRITTEN OFFER(S) AND NEGOTIATIONS RECORD:** This form documents the offer(s) to the landowner and serves as a record of negotiations. Usually the County Highway Superintendent / City Engineer acts as the Negotiator. This form is also the record for a settlement at a figure other than the estimated value. Authorization and detailed justification of any additional compensation must be provided by the County Commission Chairperson / City Mayor. A separate form must be completed for each parcel. When signed, the local government shall maintain the original and the Local Transportation Programs Office shall receive a copy of this form.

**LGA-ROW-5, RIGHT-OF-WAY AGREEMENT:** This form is an agreement with the owner for the purchase. There is space on the agreement to document any special agreements such as fence, approaches, crop damage, etc. When signed, the local government shall maintain the original and the landowner and Local Transportation Programs Office shall each receive a copy of this form.

The foregoing forms and procedures cover donations, uncomplicated valuations, negotiations and ROW agreements. The actual conveyance of the property from

the landowner to the local government is accomplished by the deed. The standard Highway Use Deed is useful for this purpose. Any other approved deed that the local government is now using may also be used. The deed must be signed, notarized and filed with the Register of Deeds. Consult with your States Attorney in drawing the deed or in making any changes to this proposed form.

There may at times be moving expense and relocation assistance and payments required. This could involve haystacks, machinery, signs, etc. Any relocation assistance and payments required for a project will be handled by State forces due to the detailed regulations that are involved. Where relocation assistance and payments are required, contact the Local Transportation Programs Office.

If there are parcels to be acquired involving values greater than \$10,000 or having complications, different procedures and forms are involved. This activity will usually be handled by State forces due to the detailed regulations that are involved. Where the situation arises, contact the Local Transportation Programs Office.

Before the project can be advertised for bids, copies of all the foregoing forms are to be provided to the Local Transportation Programs Office in sufficient time to allow for a detailed review, as well as an original of the following:

**LGA-ROW-6, RIGHT-OF-WAY CERTIFICATE:** This document is the local government statement that ROW acquisition has been accomplished in accordance with the Uniform Act. To be valid, this form must be dated after the last date of the other forms noted above. The State must provide Right-of-Way Certification to the Federal Highway Administration before authorization to advertise the bids is given.

Each of the forms lists a specific title of person to sign on behalf of the local government. If someone else has been given administrative authority by the commission to sign on behalf of the local government, that person can sign the forms as long as a copy of the documentation designating that individual, by name, with signature authority is provided to this office along with the forms. The individual can simply cross off the title shown on the form and write in their own.

A version of each applicable form is available upon request for the following categories of donors or grantors:

- individuals (which includes partnerships, and sole proprietorships)
- corporations
- limited liability companies (LLC's)
- local governments



The LGA-ROW forms were reviewed and approved February 5, 2009, by the SDDOT offices of Right of Way, Legal Counsel, Local Transportation Programs, and the South Dakota Division of the Federal Highway Administration.



The South Dakota Department of Transportation provides services without regard to race, color, gender, religion, national origin, age or disability, according to the provisions contained in SDCL 20-13, Title VI of the Civil Rights Act of 1964, the Rehabilitation Act of 1973, as amended, the Americans With Disabilities Act of 1990 and Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, 1994.

Any person who has questions concerning this policy or who believes he or she has been discriminated against should contact the Department's Civil Rights Office at 605-773-3540.

